Global Justice Now

From the roots up

How agroecology can feed Africa

February 2015

By Dr Ian Fitzpatrick

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About Global Justice Now

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Cover image: Philipina Ndamane holding up some of the vegetables she has grown in the Abalimi Bezekhaya garden in Guguletu, Cape Town, South Africa. Credit: dfataustralianaid

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Multinational corporations, aided by governments, are vying to increase their control of land, seeds, markets and labour in Africa. Donors, development agencies and multilateral financial initiatives continue to push a one-size-fits-all industrial model of agriculture. Agribusiness investment is increasingly being seen as the only way to address hunger and poverty. One such initiative is the New Alliance for Food Security and Nutrition which, backed by over £600m of UK aid, is leveraging policy changes to help corporations increase their control of agricultural markets and resources in Africa.

This one-size-fits-all industrial model of agriculture is being pursued at the expense of small-scale farmers who produce 70% of Africa's food by using, in many cases, sustainable agriculture methods, also known as agroecology. Studies show that agroecology leads to increases in food productivity and yield which are comparable to, or better than, corporate-controlled agriculture. Agroecology also leads to better opportunities for women, increased income, employment, agricultural biodiversity, health and nutrition, as well as helping to mitigate the impacts of climate change.

The UK government must commit to promoting the principles of agroecology and food sovereignty in order to help farmers across Africa truly transform their food system.

Agroecology and food sovereignty

Agroecology encompasses the science of ecological principles as applied to food systems, the practices and techniques of sustainable farming, and a movement that addresses the social, economic and political aspects of food systems.[1] Agroecological methods improve the opportunities for local control, emphasise the use of local resources, local knowledge, and take into account how food is produced.

Around the world, peasant organisations, pastoralists, fisher folk, indigenous peoples, women and civil society groups are forming a movement for food sovereignty which allows communities control over the way food is produced, traded and consumed.[2] Food sovereignty, therefore, provides the framework within which agroecological systems and techniques should be developed.

World Agroforestry Centre

Gliricidia intercropped with maize.

Agroecology in action

What marks out agroecology is the huge variety of techniques that are all based on a low-input sustainable approach to farming. Despite the lack of resources and funding for research into agroecology, the evidence that is available shows unequivocally that agroecology must be taken seriously.

This evidence shows that agroecology leads to:

- **Better use of resources**:
  Agroecological techniques, ranging from community seed banks, water harvesting and applying compost, are helping small-scale farmers across Africa manage resources sustainably and reduce the need for expensive and unsustainable inputs. For more examples, see page 21.
- **Better ways of growing food**:
  The adoption of sustainable crop-growing systems, ranging from agroforestry, conservation agriculture, homegardens and the 'system of crop intensification', are helping farmers increase their yields and reduce their impact on the environment. For more examples, see page 29.
- **Better ways of learning**:
  Through participatory learning, research programmes, and approaches such as participatory plant breeding and farmer field schools, agroecology values and develops the knowledge and skills of small-scale farmers. For more examples, see page 37.

Community Eye Health

Women selling orange-fleshed sweet potatoes in Nigera.

Benefits of agroecology

The evidence shows that agroecology and small-scale sustainable farming can produce as much food, and often more, as industrial farming and better uphold agriculture's social and environmental functions. But the benefits of agroecology go beyond productivity and yield and include:

- **Reducing the gender gap**:
  Agroecology helps to put women in a stronger economic and social position through, for example, Farmer Managed Natural Regeneration,[3] and community seed banks help to focus local food systems on women's needs as food producers.[4] For more case studies, see page 41.

Bioversity International / Y. Wachira

Africa finger millet

- **Increasing employment and income**: Many case studies show that agroecology provides decent jobs and a way out of poverty. For example, farmers in Kenya using push-pull technology were able to earn three times more income than farmers using chemical pesticides.[5] For more case studies, see page 44.
- **Increasing agricultural biodiversity**: Organic farming systems can have up to 30% more species on them than conventional farms,[6] and crop diversity can help farmers adapt to changes in heat, drought, pests and low soil fertility. For more case studies, see page 45.
- **Improving health and nutrition**: Diversity is intrinsically linked to people's health and nutrition and small-scale farms practising agroecology tend to be more diverse than conventional farms. For example, the Soils, Food and Healthy Communities Project, a participatory agriculture and nutrition program in northern Malawi, was able to improve child health, crop diversity and food security by using sustainable agriculture techniques combined with education. For more case studies, see page 46.
- **Addressing climate change**: The Intergovernmental Panel on Climate Change has said that agroecological practices can help with the impacts of climate change and reduce greenhouse gas emissions.[7] For more case studies, see page 48.

Overcoming the barriers

There is now extremely good evidence that small-scale sustainable farming, which is controlled by and for communities, can play a central role in feeding communities sustainably, as well as improve livelihoods and gender relations. So why are governments, development agencies, policy makers and funders so focused on large-scale, high-input solutions which marginalise small-scale farmers?

This report outlines the economic and political barriers preventing agroecology from being more widely adopted and shows that these barriers can be overcome by:

- **Changing the political bias**: A change in the ideological support for industrial agriculture towards agroecology and sustainable small-scale agriculture will require the political establishment and development agencies to formulate policies based on scientific evidence and the long-term viability of our global food system.
- **Changing trade rules and policies**: Policies should be designed to uphold the autonomy and sovereignty of governments receiving aid, so that they are able to regulate their economy and support agroecology.
- **Increasing investment**: Small-scale farmers should be protected and supported as key investors in their sector, including helping them to access fair credit.

- **Increasing research**: Although there is increasing evidence of the benefits of agroecology, there is still a need for more research and a serious lack of funding for it compared to research on conventional agriculture.
- **Focusing on small-scale solutions**: Governments and financial institutions need to overcome a blinkered focus on large-scale farming, including through projects like agricultural growth corridors and high-tech mechanisation.[8] The future wave of innovation will need to come from farmers themselves and farmer-based research and development.
- **Improving land tenure arrangements**: Improving land tenure arrangements should go hand-in-hand with land reform and redistribution which prioritises the needs of small-scale farmers and farming communities.

World Agroforestry Centre

Nelson Mkwaila in a field of maize, with fertiliser and fruit trees

Policy proposals

This report shows that, despite many barriers, small-scale farmers in Africa are already using agroecological solutions to feed their community, build resilient livelihoods and reduce their impact on the environment. To help overcome the barriers faced by agroecology and sustainable small-scale agriculture, the governments of the UK and other aid donors should:

- Support food sovereignty by recognising and supporting policies and actions within the food sovereignty framework.
- Increase investment into agroecology by aligning UK aid spending on food and agricultural-related projects with the principles of agroecology defined within the framework of food sovereignty.
- Increase research and the evidence base by realigning funding and research agendas towards sustainable farming and agroecology.
- Focus on small-scale solutions by promoting the development of community seed banks, farmer field schools, agroecology schools, demonstration farms and farmer-to-farmer exchanges.
- Help small-scale farmers increase access to, and control of, land and resources.
- Support women farmers by explicitly targeting women farmers and women farmer groups through agricultural projects, agricultural extension, research and rural credit programmes, and supporting women farmers' access to resources including land, seeds and finance.
- End support for the corporate-control of African food systems by stopping UK aid money being used to fund food and agricultural projects which favour big business and put the livelihoods and resilience of small-scale farmers at risk.

1. Foreword

Sustainable Agriculture Tanzania

Compost prepared by the Upatacho Group in Mgeta, Tanzania.

Agroecology isn't just a set of farming practices – it's also about who controls our food.

Sympathy with organic food production is at an all-time high. Perhaps "It's a nice idea, when you can afford it" sums up the approach of many people. But to extend these principles of production to the whole food system? It just doesn't seem practical. There are an awful lot of people to feed in the world, and if you're hungry, you don't care much about the niceties of how the food was produced.

This report shows that not only *can* small-scale organically produced food feed the world, but it can do so better than intensive corporate-controlled agriculture. As a matter of fact, it already is feeding millions of people.

In Tigray, Ethiopia, farmers have seen grain yields double, with increased biodiversity and fertility, not to mention less debt. In Senegal, agroecological pest management techniques have allowed farmers to produce 25% more rice than conventional farmers. In southern Africa, more than 50,000 farmers practising agroecology have increased maize yields by 3–4 metric tons per hectare.

But what we're talking about in this report isn't a set of farming techniques. **We're talking about who controls our food supply and how that power is used.**

How we produce food is a deeply political issue that affects the lives and livelihoods of *billions* of people. In our global economy, it is not the amount of food produced which dictates whether

people eat or starve. If it was, we would not see the inhumane but common spectacle of people malnourished while surrounded by food. Rather, it is the increasing grip which big business exerts over our food system, in accordance with a near religious faith in the power of the market.

So agroecology does not simply say 'we can grow more'. It says, we can give people control over their food. It goes beyond a simple notion of 'food security' because, as the writer Raj Patel points out, "it's possible to be food secure in prison". By shifting the way food systems are controlled, agroecology can play a part in challenging the patriarchal forms of organisation that exist in farming.

Agroecology poses a challenge to the dogma of the free market, in whose name so many millions have starved over two centuries. It posits a system of production and distribution which treats people as deserving of control over their lives, and nature as deserving of our respect. It says that if we want a just and sustainable food system, we need a paradigm shift in how food is produced and distributed.

We can and should start building this movement for food justice everywhere. But we focus this report on Africa because it is in Africa that an all-out offensive is taking place against smallholder farming. Under the guise of a 'new green revolution', food is being removed from the control of those who farm it, and land from those who till it. There's a good reason: while 75% of all seeds planted across the world are owned by one of ten companies, in Africa 80% of all seeds still come from systems managed by farmers. That's a lot to play for.

Look at Malawi, where under the UK-supported New Alliance for Food Security and Nutrition the government is being told to eliminate export bans, make life easier for corporate 'investors', implement new intellectual property laws over seeds, and sell land for large-scale commercial agriculture. This is nothing to do with helping Africa feed itself; it is about further empowering an already very powerful and bloated agribusiness sector.

This needs to be challenged – to bring an end to the latest crusade for Africa's resources. But we can go further and, by supporting agroecology in Africa, begin to glimpse what a more democratic food system would look like for the whole world. This also means supporting women farmers, who have least control over the food system, in claiming their rights to land and food.

Finally, **this report provides a policy framework for foreign governments that really want to help African farmers** and compensate for some of the terrible resource theft which has been committed over the centuries. This means a radical reform of the aid system, which is currently doing more to entrench, than to break, corporate control. It means standing up against a number of trade agreements currently being negotiated, which will give corporations new powers to grab land, monopolise seed distribution and benefit from an export-to-the-West model of growth.

We urge the British government, in particular, to stop imposing our own broken food model on Africa, to see that Africa's first priority must be justice for Africa's people, and to commit to promote the principles of agroecology and food sovereignty.

Nick Dearden

Director, Global Justice Now

2. Introduction

Small-scale farmers produce over 70% of the food consumed in Africa on less than 15% of the agricultural land available on the continent. Africa can feed itself with sustainable farming, despite the rules being rigged in favour of industrial agriculture.

Africa is seeing a new wave of colonialism as multinational corporations, aided by rich governments and financial institutions, vie to increase their control of land, seeds, water and other resources. The continent has been described as the "last frontier in global food and agricultural markets" by the World Bank,[9] and private sector and corporate investment is, therefore, seen as both a good investment opportunity as well as the only way of boosting agricultural production and helping to lift people out of poverty.

The reality is that sustainable small-scale[i] farmers produce over 70% of the food consumed in Africa,[10] on less than 15% of the agricultural land available on the continent. Despite this, donors, development agencies and multilateral financial initiatives, like the New Alliance for Food Security and Nutrition (New Alliance) and the Alliance for a Green Revolution in Africa, continue to push a one-size-fits-all industrial model of agriculture and make exorbitant claims about their aims. The New Alliance initiative, launched in 2012, aims to achieve "sustained and inclusive agricultural growth and raise 50 million people out of poverty over the next 10 years".[11] What it doesn't mention is that some of the projects it finances, such as agricultural growth corridors in Burkina Faso, Ghana, Malawi, Mozambique and Tanzania (which the UK's Department for International Development (DfID) has spent almost £70 million financing),[12] have been described as "likely to facilitate the appropriation of land and the displacement of small-scale farmers, while imposing high-input, industrial agriculture using hybrid and GM seed".[13]

DfID is currently channelling £600 million of aid money through the New Alliance to support agricultural development and improve food security in Africa.[14] Initiatives like the New Alliance are, in fact, aimed at helping multinational companies to access resources and bring about policy changes which will help them expand in

i. In developing countries, small-scale farmers are usually defined as people who farm on 2 hectares or less.

Africa at the expense of the small-scale food producers who feed most of the continent's population.[15] For example, the Cooperation Framework to Support the New Alliance in Malawi includes objectives such as: eliminating export bans, fast tracking 'doing business reforms' to reduce risk for private sector investments, getting the government to "release 200,000 hectares for large scale commercial agriculture by 2015" and passing new crop variety protection legislation which will, in effect, weaken small-scale farmers' rights and ability to save, share and exchange their own seed varieties. This, despite the fact that Malawi moved away from a liberalised agricultural model following the 2002 famine which had been partly caused by similar structural adjustment policies imposed by the International Monetary Fund and the World Bank.[16]

Aided by governments and the lack of regulation, multinational corporations have been able to take control of large parts of the global economy as well as our food system. Today, only six companies control 60% of the world's commercial seed market, ten fertiliser companies account for more than 40% of the global market, worth an estimated US$200 billion in 2012 alone,[17] and eleven companies have almost complete control (98%) of the world's pesticide market. The largest four grain traders control around 90% of global grain trade,[18] and five companies control half of global coffee trade, with just three companies controlling almost 70% of the UK retail coffee market.[19]

When a handful of companies control such a large proportion of any sector of the economy, they act like a cartel, reducing competition and increasing their profits.[20] In the context of the food system, those at the bottom of the food chain – the peasants, family farmers and rural workers – find it increasingly hard to earn a living while those at the top make huge profits. In 2013, Monsanto and Syngenta made a profit of US$2.5 billion and US$1.6 billion respectively,[21] more than the US$3.2 billion the World Food Programme has estimated would be needed to feed the world's 66 million hungry school-aged children.[22]

The rules that control how our food system works are written by, and for, large corporations rather than the millions of people who produce and consume food. These rules have facilitated a corporate power grab which has spread across the world. Government bodies, aid donors and development agencies such as the World Bank have been active agents in this corporate power grab by backing policy reforms and providing development aid that promotes industrial agribusiness as the main means of solving global poverty and hunger.

There are 2.5 billion people involved in full or part-time agriculture who work on around 500 million small-scale farms and produce over 80% of the food consumed in the developing world.[23] Many of these small-scale farmers make a huge contribution to poverty reduction and food security while using agroecological techniques to improve the soil, protect and increase biodiversity, improve gender equity and mitigate some of the impacts of climate change. Yet they are under constant attack. Corporations continue to increase their control of resources, such as land, water and labour, and commercial agricultural inputs like seeds, chemical fertilisers and pesticides; insecure land tenure and complicit governments enable companies to carry out land grabs; reduced public spending on agriculture makes room for development policies which favour large-scale farming, mega-projects and the agribusiness sector; and the increasingly catastrophic impact of climate change forces small-scale farmers to give up, sell up or move out. But small-scale farmers are the key to our food future. They have an intimate knowledge of their local ecology as well as generations of practical experience producing food using sustainable agriculture techniques and fewer external inputs.

"Smallholder farmers hold a massive collective store of experience and local knowledge that can provide the practical solutions needed to put agriculture on a more sustainable and equitable footing."

Elwyn Grainger Jones, Director of IFAD's Environment and Climate Division[24]

"Supporting smallholder farmers to play a greater role in food production and natural resource stewardship is one of the quickest ways to lift over one billion people out of poverty and sustainably nourish a growing world population."

International Fund for Agricultural Development report, 2013[25]

There are numerous reports on the state of sustainable farming around the world.[26] These reports provide evidence of the huge contribution sustainable farming can make to our food system and often contain detailed policy proposals to encourage policy-makers, funders and governments to adopt sustainable farming and make it a more widely accepted practice. This report differs from others by focusing specifically on Africa and the positive impacts that agroecology and small-scale sustainable farming are having there. These impacts are not just about higher productivity or yield. They are also about social and economic outcomes such as gender, labour, income and health. The report also outlines some of the economic and political barriers preventing sustainable farming techniques from being more widely adopted and small-scale farmers from getting the support they need to develop, improve and share their agricultural practices.

This report sides with farmers' movements, like La Via Campesina and countless farming and food sovereignty organisations around the world, in believing that agroecology is the only way of feeding the world fairly and averting a global food crisis. As a letter recently signed by almost 70 international food scientists puts it: "(Scientists and scholars) view agroecology as a well-grounded science, a set of time-tested agronomic practices and, when embedded in sound sociopolitical institutions, the most promising pathway for achieving sustainable food production."[27]

Agroecology and the rhetoric of sustainable agriculture, in general, have become widely discussed and accepted as viable alternatives to industrial agriculture. But barriers to larger scale adoption remain. Some of these barriers come from a lack of public awareness about these alternatives, but one of the biggest barriers is political will. A large number of recent studies have come out strongly in favour of agroecology, but these positive stories seem to have done little to increase government and donor support for agroecology. What is needed now, more than anything else, are decision makers to support a paradigm shift. This sort of shift would allow an agroecological approach to truly make its case as a tool for producing a more sustainable, democratic and resilient food system. As a report by the International Fund for Agricultural Development (IFAD) puts it: "**With the right conditions, smallholders can be at the forefront of a transformation in world agriculture.**"[28]

This report seeks to address, head-on, the claim that only industrial agriculture delivered by large-scale farming and financed by multinational corporations can feed Africa. Instead it aims to demonstrate that Africa can feed itself with sustainable farming despite the rules being rigged in favour of industrial agriculture. Africa needs donors, governments, international institutions and corporations to recognise the value and multiple impacts of agroecology, and radically shift their current approach in favour of sustainable small-scale farming.

FAO

Farmers in Hangachafa Village, Hawassa, Ethiopia, sift beans from dirt, dust and hay.

3. Agroecology and food sovereignty

"As a way to improve the resilience and sustainability of food systems, agroecology is now supported by an increasingly wide range of experts within the scientific community, and by international agencies and organizations, such as the United Nations Food and Agriculture Organization (FAO), UNEP and Bioversity International."

Olivier De Schutter, United Nations Special Rapporteur on the right to food, 2008– 2014[29]

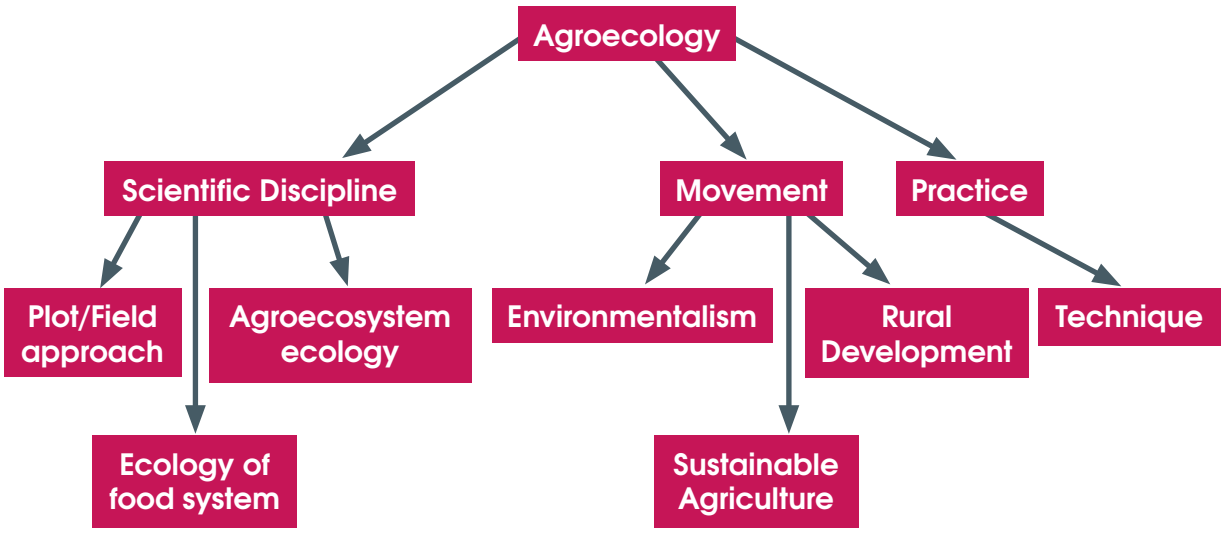
3.1 What is agroecology?

Agroecology encompasses the science of ecological principles as applied to food systems, the practices and techniques of sustainable farming, and a movement that addresses the social, economic and political aspects of food systems.[31] A study of sustainable farming should focus as much on the rights of farmers, issues of land distribution, and the impact of big business on people's livelihoods, as it should on farming methods and yields.

In this report, we use agroecology to cover a large number of terms related to sustainable farming. The advantage of using this term is that it refers to more than just the sustainable production of food, and the techniques and technologies associated with it. Another reason to use the term agroecology is that, together with the term food sovereignty, it is widely used by the international movement La Via Campesina, which has over 200 million peasant farmer members in 160 organisations and 79 countries,[33] as well as other groups in the global south. While La Via Campesina makes frequent use of the term agroecology, they are careful to point out that they support farming principles rather than focusing on terms alone:

> ***"We can find examples of sustainable peasant and family farm agriculture all over the planet, though the names we use vary greatly from one place to another, whether agroecology, organic farming, natural farming, low external input sustainable agriculture, or others. In La Via Campesina we do not want to say that one name is better than another, but rather we want to specify the key principles that we defend. Truly sustainable peasant agriculture comes from a combination of the recovery and revalorization of traditional peasant farming methods, and the innovation of new ecological practices … We do not believe that the mere substitution of 'bad' inputs for 'good' ones, without touching the structure of monoculture, is sustainable … The application of these principles in the complex and diverse realities of peasant agriculture requires the active appropriation of farming systems by peasants ourselves, using our local knowledge, ingenuity, and ability to innovate."[34]***

Figure 1: **Diversity of current types of meanings of agroecology**



Source: Wezel et al. 2009[32]

It's not just about crops

Agroecology is not only about crop production. Agroecological principles can be applied to agroforestry, aquaculture and fisheries management, urban farming, animal husbandry and pastoralism, as well as the production of non-food crops and fuel. In this report we focus on agroecology as applied to agriculture and the production of plant food in particular, as this provides the bulk of what most people in Africa consume.

3.2 What is food sovereignty?

There is a global movement of farmers and peasants who actively protect and promote small-scale sustainable farming as an alternative to high-input industrial agriculture. This movement, which brings Global Justice Now together with La Via Campesina and its 200 million peasant farmer members – as well as other peasant organisations, pastoralists, fisher folk, indigenous peoples, women, rural youth and environmental and development organisations – has gathered around the term food sovereignty. Food sovereignty is about the right of peoples to define their own food systems. Advocates of food sovereignty put the people who produce, distribute and consume food at the centre of decisions on food systems and policies, rather than the demands of global markets and corporations that have come to dominate the industrial food system.[35]

donkeycart

Entrance to Nyeleni, World Forum for Food Sovereignty, Selingue, Mali

The six pillars of food sovereignty were developed at Nyéléni, Mali, in 2007 at the Forum for Food Sovereignty:

Six pillars of food sovereignty

1. Focuses on food for people: The right to food which is healthy and culturally appropriate is the basic legal demand underpinning food sovereignty. Food is not simply another commodity to be traded or speculated on for profit.
2. Values food providers: Food sovereignty asserts food providers' right to live and work in dignity.
3. Localises food systems: Under food sovereignty, local and regional provision takes precedence over supplying distant markets, and export-orientated agriculture is rejected.
4. Puts control locally: Food sovereignty places control over territory, land, grazing, water, seeds, livestock and fish populations on local food providers and respects their rights. Privatisation of such resources, for example, through intellectual property rights regimes or commercial contracts, is explicitly rejected.
5. Builds knowledge and skills: Technologies, such as genetic engineering, that undermine food providers' ability to develop and pass on knowledge and skills needed for localised food systems are rejected. Instead, food sovereignty calls for appropriate research systems to support the development of agricultural knowledge and skills.
6. Works with nature: Food sovereignty requires production and distribution systems that protect natural resources and reduce greenhouse gas emissions, avoiding energy-intensive industrial methods that damage the environment and the health of those that inhabit it.[36]

3.3 Food sovereignty vs. food security

Food sovereignty goes beyond the concept of food security that the big aid donors and neoliberal[ii] international institutions prefer. Food security simply aims to ensure that people have sufficient food to eat. It is not concerned about how this food is produced, or where or by whom, nor the means by which people might attain this fundamental right. By contrast, food sovereignty requires not just that everyone is properly fed, but that the food system that feeds us is just and sustainable.

> ***"Food security is the idea that governments use to talk about citizens not being hungry, and it means that you have access to enough food to live healthily. Sounds like a good definition, except for when you realize that it's possible to be food secure, say, in prison. You've got access, after all, so you're not going hungry. But food security never talks about power in the food system — just your access to food. Food sovereignty is like food security, except that under food sovereignty, communities actually get to shape their own food policy and shape the terms under which everyone gets to eat."***[37]
>
> **Raj Patel, writer, activist and research professor at the University of Texas, USA**

3.4 Food sovereignty, the framework for agroecology

There is a strong link between the six pillars of food sovereignty and the social and political aspects of agroecology. Many of the pillars, such as 'localising food systems' and 'putting control locally', relate directly to agroecology as a movement, and the rejection of genetic engineering and 'working with nature', refer directly to agroecological techniques. Food sovereignty provides the framework within which agroecological systems and techniques should be developed.

Agroecological methods improve the opportunities for local control, emphasise the use of local resources and local knowledge, and take into account how food is produced. Large farms tend to be managed with less labour and a focus on fewer crop varieties and high output per hectare, rather than higher agricultural biodiversity, labour demands, and integration of animals with crops on smaller farms.[38] Therefore, small-scale, biodiverse farms with minimal use of external inputs would be more likely able to follow agroecological practices and help to achieve food sovereignty. While there are many forms of small-scale 'sustainable farming' that could help realise this, the term 'agroecology' is becoming co-opted by industrial agriculture and researchers to 'green' large-scale production systems using sustainable intensification practices – often these are put under the generic heading of Sustainable Agriculture.

3.5 The many sustainable farming terms

There are literally dozens of terms used to refer to sustainable farming. These include ecological agriculture, conservation agriculture, multi-functional agriculture, organic agriculture, sustainable intensification, climate-smart agriculture, no-till farming and low-external-input farming. While many of these approaches share a concern with limiting or reducing resource use in food production, they all have a slightly different emphasis overall and some are used as greenwash[iii] by corporations.

Sustainable intensification broadly refers to the idea of producing more output with less negative environmental impact, but the term has been co-opted by agribusiness as a means of pushing a technology-based approach and marketing their products as part of the solution.[39] The term is popular with government bodies, donors and development agencies, and agribusiness companies and research institutions,[40] but has been rejected by NGOs such as Friends of the Earth and social movements like La Via Campesina:[41]

> ***"So called 'sustainable intensification' is not really about increasing yield per acre, it is more about green-washing large scale industrialized production following the old adage 'get big or get out'. Increasingly, peasant and smallholder family farmers have to produce crops for the commodity market and not for local and regional food systems."***[42]

ii. We define neoliberalism as a politico-economic theory that favours free trade, privatisation and reductions in government spending.
iii. Disseminating misleading information to present an environmentally responsible public image.

Climate-smart agriculture is another term that has recently been gaining currency with development agencies like the Food and Agriculture Organization (FAO) and the Department for International Development (DfID),[43] as well as the private sector and research bodies like CGIAR. According to a press release issued by the UN at the launch of the Global Alliance for Climate-Smart Agriculture in 2014, multinationals like Walmart, McDonald's and Kellogg's have committed to increasing the amount of food in their supply chains that are produced with climate-smart approaches. IFAD and the World Bank announced that 100% of their agricultural investments (around US$11 billion) would be climate-smart by 2018, and CGIAR would invest US$10.2 billion over the decade on climate-smart agriculture research.[44] But both the Global Alliance and the term 'climate-smart agriculture' have been roundly rejected by a coalition of 107 international and national organisations and farmers' movements.[45] This coalition describes the alliance as a deceptive and deeply contradictory initiative which would help endorse "the activities of the planet's worst climate offenders in agribusiness and industrial agriculture".

The term climate-smart agriculture is rejected for three main reasons. Firstly, because the final framework of the Alliance contains no definitions of what can or cannot be accepted as 'climate-smart', giving plenty of room to industrial approaches such as genetic modification and the use of chemical fertilisers to claim they are solving climate change. Secondly, 'climate-smart' projects will be able to claim money through carbon offset schemes, which poses a risk to the environment and food security and increases the risk of land grabbing.[46] Thirdly, the term has been adopted by a number of companies (including Yara,[47] one of the first companies to promote the idea of agricultural growth corridors) whose activities are already having negative impacts on farmers and communities in the global south through land grabbing and the promotion of high-input, corporate-controlled agriculture.

Each of these terms has their moment in the spotlight. At the moment, sustainable intensification and climate-smart agriculture are the buzz-words used by governments and agribusiness when talking about improving agriculture. In the near future there is a risk that words like agroecology may get co-opted by private sector donors and development agencies and their true meaning distorted in the process.

3.6 The International Symposium on Agroecology

Immediately after FAO's International Symposium on Agroecology for Food Security and Nutrition held at FAO in Rome in September 2014, the President of the Latin American Scientific Society of Agroecology (SOCLA) published a short report listing the most important conclusions which had emerged from the symposium. These are in line with the food sovereignty framework and include:

- Agroecology is a series of ecological and social principles, not a box of tools or technological recipes.
- Agroecology questions the dominant food system and proposes a radical transformation of it with producers at the centre.
- Agroecological interventions embrace the food system as a whole, including environmental, socioeconomic and political dimensions, and therefore transcend the farm scale.
- Agroecology is deeply rooted in both the wisdom of peasants' knowledge, practice and innovation, as well as modern science.[48]

SOCLA also pointed out that a global agroecology network would have to stay vigilant "so that the real dimensions of agroecology are not distorted or co-opted", and quoted FAO's Director General as stating that agroecology had opened a window in the "cathedral of the green revolution". [49]

3.7 The Green Revolution

The term Green Revolution (GR) was originally coined to describe a period of agricultural development from the 1960s through to the 1970s, which combined the use of improved seed varieties, chemical inputs and irrigation to increase crop yields in Asia and Latin America. The GR was able to increase grain yields in the short-term, but these increases depended on the intensive use of chemical fertilisers and pesticides, as well as the availability of good irrigation systems and modern machinery. Poorer farmers were often either unable to afford the expensive inputs, or became trapped in a cycle of debt and dependency. The GR's focus on monoculture cultivation, using few varieties of wheat, rice and maize, drastically reduced on-farm seed diversity and had a hugely negative impact on the diversity of plant foods produced, and the intensive use of chemicals resulted in considerable health and environmental impacts.[50] These same problems are now emerging in countries in Africa that have had the Green Revolution model imposed on them.

In Malawi, small-scale farmers have been encouraged to use chemical fertilisers and hybrid seeds through government subsidies. Even though subsidised, the cost of these chemicals is often more than the additional income farmers get from the unreliable increase in yields, leading many farmers into debt while the seed and fertiliser agribusiness companies profit.[51] But this is not all. The use of chemical fertilisers over a long time can lead to a dramatic fall in soil fertility and soil biodiversity and, therefore, of soil productivity and the efficiency of using chemical fertilisers themselves. It is this loss of soil fertility – linked to the over application of chemical fertilisers – that has been blamed for grain production stagnating in large parts of Asia in recent times.[52]

A recent scientific study on the effect of synthetic nitrogen fertilisers concluded that long-term sustainability in cereal production would require agricultural diversity and a transition from chemical fertilisers to legume-based crop rotations.[53] Additionally, African governments, by providing costly, but politically popular, agricultural subsidies for chemical fertilisers, are diverting resources away from the important work of crop and soil science and the development and promotion of less expensive, more biodiverse and locally available alternatives for increasing soil fertility.[54]

3.8 Positive solutions

The focus of this report is on the success stories emerging from farming communities across Africa involved with agroecological methods. Many of the techniques farmers are using fit under the umbrella of agroecology but can equally be defined as practices related to organic farming, ecological farming, sustainable intensification, multi-functional agriculture, or other related terms.

This emphasis on positive solutions serves a number of purposes. Firstly, it aims to change the widely held perception of Africa as a continent with a single story: a continent whose progress is marred by poverty, famine, starvation, corruption, extreme weather, disease and war. Of course, the continent is already feeling the effects of climate change most acutely, and some African countries are experiencing social and economic upheaval. But Africa contains within it a huge range of countries, cultures, climates and conditions, and the reality is much more complex. The single story brushes over the fact that huge numbers of farmers and farming communities throughout Africa are busy developing and deploying positive solutions to improve the sustainability and resilience of their food system.

Secondly, these positive solutions serve as evidence that there are alternatives to high-input conventional agriculture, and that these alternatives are already having considerable impact across Africa and, in fact, have worked for decades despite low levels of financial and research support, the ongoing and increasing threat from climate change, and unfair trade rules that favour developed countries and large-scale producers. These solutions highlight how Africans already know how to produce enough food to feed themselves but that the political and economic rules which govern the food system are set against them. Finally, these positive solutions provide an evidence base to support specific policy recommendations as an alternative to the Department for International Development's current support for agribusiness and the privatisation of Africa's food system.[55]

4. Agroecology in action

CAFOD

Agroecological farming in a collectively-run greenhouse in Kenya.

"Agroecology encourages a holistic approach and the integration of humans, plants, animals and the environment, into a system where all involved help each other and create important relationships which result in healthy people, healthy plants, healthy animals and a healthy environment"

Janet Maro, Sustainable Agriculture Tanzania

What marks out agroecology is the huge variety of techniques that are all based on a low-input sustainable approach to farming. Many of these techniques are widely practised by farmers across Africa and help to increase food yields while maintaining healthy soils without the need for expensive technologies. Because many of these techniques are inexpensive, simple and effective, there has been little commercial interest in researching, developing and distributing them. There has also been relatively little documentation of agroecological practices to accurately measure their impacts on a variety of indicators such as yield, income, health and gender equality as compared to conventional farming. There are,

therefore, thousands of agroecological case studies in the field waiting to be documented but few resources and little funding to do this. Additionally, some of the documentation that has been carried out has been of poor quality and fails to provide adequate before and after measures to determine the impact of an agroecological intervention.

Despite the lack of resources and funding for research into agroecology, the evidence that is available shows unequivocally that agroecology must be taken seriously. By eliminating the need for chemical fertilisers and pesticides, using techniques such as integrated pest management, giving farmers, rather than corporations, the ability to save, breed and trade seeds, and improving water management, agroecology leads to better use of resources. Through the use of techniques ranging from agroforestry, farmer-managed natural regeneration, conservation agriculture and the system of crop intensification, agroecology leads to better ways of growing food. Finally, by using participatory plant breeding and developing farmer field schools, agroecology leads to better ways of learning.

4.1 Better use of resources

4.1.1 Fertility and fertilisers

Industrial agriculture relies on synthetic pesticides and chemical fertilisers to increase crop yields. They come at a high economic and environmental cost to small-scale farmers who purchase them on a yearly basis. This form of high-input intensive agriculture has been successful at increasing yields and delivering short-term profits for farmers, but comes at a price: pesticide residues accumulating in ground water; health risks to farm workers exposed to chemical sprays;[56] increased soil erosion;[57] reduced biodiversity; and loss of farmer control of resources. All these impacts are exacerbated for women who produce most of the food consumed in rural parts of the world and in some parts of Africa work more hours than men,[58] leading them to be more exposed to the chemicals being sprayed on fields.

Conventional agriculture, which is a water, energy and chemical-intensive method of farming, is generally not suited to the drought-prone land present over a large part of Africa: 34% of Africa is arid or semi-arid land.[60]

> ***"For years, the government provided free chemicals and fertilizers to farmers as part of the Green Revolution strategy. Now, we see that this has led to serious land degradation. The farm lands are in a terrible state and do not produce enough food to feed the families. This has led me and fellow women farmers to begin to sensitise other women about the effects of pesticides on vegetables and food crops ... At a recent food fair, we displayed our local traditional foods, on which no pesticides are used. These crops are also highly nutritional and drought resistant ...These activities have contributed to the spread of farming practices that don't use agrochemicals. In some of the villages, the women no longer spray chemical pesticides. They collect animal droppings and use them as manure and to deter harmful insects. There is also a visible increase in the availability of traditional food and crops at the markets. One example is dawa-dawa, a local condiment that used to be popular before being abandoned for industrial Maggi cubes. We see the promotion of healthy, traditional crops as a step towards food sovereignty for rural women in northern Ghana."***[59]
>
> **Patricia Dianon, chair of the Rural Women Farmers Association of Ghana**

A great example of using agroecological methods to increase crop yields and restore soil quality is the work carried out by the Ethiopian Institute for Sustainable Development (ISD) in the Tigray Region of northern Ethiopia. In 1995, the ISD, in collaboration with a group of farming communities, trained farmers to produce compost and apply it to their crops instead of using chemical fertilisers. The results were immediately positive. Yields from composted crops were higher than crops which had received chemical fertiliser.[61] The regional development government adopted compost training as part of its strategy for helping farmers improve yields and by 2007 over a quarter of all farmers in the region were making and using compost.[62] Grain production in the region as a whole almost doubled between 2003 and 2006, from 714 to 1,354 thousand tonnes, while the use of chemical fertilisers has dropped by 40% since 1998.[63] Part of the reason crop yields are increasing may also be because farmers are using their own seed varieties which are better suited to the sort of soil fertility created by adding compost, whereas commercial seeds may be better adapted to producing higher yields with chemical fertiliser inputs.[64]

The Tigray project had a wide range of positive effects including:[65]

- Higher yields: crops yields using organic fertiliser which are equal to, and often better than yields from chemical fertiliser.
- Increased biodiversity: farmers that previously grew wheat, barley and teff (Ethiopia's staple crop) now also grow maize and a variety of beans. Increasing on-farm biodiversity makes the food system more resilient to climate change.[66]
- Reduced weeds: fewer weed seeds, pathogens and pests in fields applied with compost due to the high temperatures of the composting process.
- Improved water retention: crops grown in composted soil will resist wilting for up to two weeks longer than soil treated with chemical fertiliser – an important consideration in drought-prone areas.
- Reduced debt: farmers who have replaced chemical fertiliser with compost have been able to get out of debt and save money.
- Improved fertility: composted fields retain fertility for up to three years after compost has been applied whereas chemical fertiliser needs to be applied yearly.

The former UN Special Rapporteur on the right to food, Oliver De Schutter, has spoken of the need for 'brown' and 'blue' revolutions in Africa in the form of a dramatic effort to improve soil fertility and water retention. This would have the effect of making farmers less dependent on expensive and usually imported chemical fertilisers – the basis of the Green Revolution – as well as making agriculture more resilient to droughts and climate change.[67] There are a number of other projects in Africa which have focused on improving soil fertility without chemical fertilisers.

The Soils, Food and Healthy Communities project in Malawi began as a way of improving both food security and soil fertility.[68] In this project the focus was on planting legumes together with other crops (intercropping) rather than composting, but the impacts were similar: improved yields and reduced use of chemical fertiliser. Starting with 30 farmers, the project now works with around 3,000 farmers who share their knowledge of soil management with other farmers. In the village of Jiya, in the southern region of Malawi, *Gliricidia* trees, which improve soil fertility, have increased maize yields five-fold in good years, and almost four-fold in average years. This has led farmers to describe these trees as a "fertilizer factory on the farm".[69] These 'fertiliser trees' provide a wide range of benefits including:[70]

- Improved soil fertility, structure and organic content (important for water retention during droughts)
- Providing extra wood and firewood for farmers, and less exploitation of forests which leads to deforestation
- Cheaper and less market-dependent fertiliser compared to chemical fertiliser
- Improved yields
- Improved crop health
- Reduction in weed problems

In Ethiopia, traditional wheat varieties, grown without the use of chemical fertilisers or pesticides, produced yields up to 10% higher than high-yielding varieties grown with chemical fertilisers.[71] Growing with agroecological methods rather than chemical fertilisers can also be more profitable. In the Ejere locality of the Addaa region, a study carried out during the 1998–99 production season showed that growing low-input varieties of wheat with crop rotation (using legumes) was actually more cost-effective and profitable than growing modern varieties which required chemical fertiliser.[72]

4.1.2 Integrated pest management

Currently, pesticide use in Africa accounts for less than 5% of global use.[73] Use per hectare is low compared to Latin America and Asia, largely because Africa still has so many small-scale farmers who use low input methods of farming. Given the current low usage across the continent, agrochemical companies such as Bayer, Syngenta, BASF and Monsanto, stand to make huge profits from governments promoting and subsidising the use of pesticides, herbicides and fertilisers.

Despite the relatively low levels of use, the impacts on health are considerable. A United Nations Environment Programme report published in 2012 stated that the potential cost of pesticide-related illness in sub-Saharan Africa between 2005 and 2020 could be as high as £56 billion.[74] A large number of studies have shown that incorrect dosages are applied without proper protection and with leaking equipment which results in the over-contamination of soil, water and air.[75] A recent study has also shown a link between maternal exposure to agricultural pesticides and neurodevelopmental disorders such as autism.[76] While the use of chemical pesticides and the application frequency continues to increase, so do the costs of buying pesticides. In Benin, during a single planting season, prices increased by 80%, meaning that farmers were spending 40% of their production costs on pesticides alone.[77]

Integrated pest management (IPM) is an agroecological technique with a long history which involves using a combination of biological controls (natural predators for pests), modified farming techniques (modifying irrigation practices), and mechanical controls (using physical traps or barriers for pests), to help manage pests and reduce the use of pesticides – which are only used as a last resort. In a number of farming projects across Burkina Faso, Mali and Niger, a parasitic wasp has been successfully used to help control a pest that damages millet.[78] In another project in Mali, around 11,000 rice farmers were trained in IPM techniques between 2001 and 2009. Farmers using IPM techniques were able to increase their income by 41% compared to conventional production methods and reduced pesticide use by 94%.[79]

In Senegal, farmers using IPM produced 25% more rice than conventional farmers with an increase in income of almost US$400 per hectare. A survey of 80 vegetable growers who had received IPM training showed that 92% of them had reduced their use of pesticides by an average of 3.2 litres per hectare helping them to save US$60 per hectare in production costs. Some of these training programmes have also carried out tests of chemical pesticide residue in local water sources, helping to raise awareness of the dangers to the environment and human health of high doses of pesticides.[80]

A related agroecological practice known as 'push-pull technology', based on the idea of using combinations of plants to either trap pests or repel them, has allowed farmers to more than double maize yields, reduce pests and increase nitrogen in the soil.[81] Over 30,000 farmers in East Africa have adopted this agroecological approach to help manage pests like stem-borer moths and African witchweed by interspersing maize plants with a perennial leguminous animal-feed crop.[82]

4.1.3 Seeds

Seeds are the basis for food production. They are also the site of increasing political and financial control by a handful of corporations. Today, just ten corporations control more than 75% of the world's commercial seed market,[83] although in Africa, an estimated 80% of all seeds still come from farmer-managed seed systems.[84] Many commercially available seeds are produced for high-input monocropping farming systems and are designed to produce higher yields when planted and treated with chemical fertilisers and pesticides. Traditional seed varieties, or local, indigenous and open-pollinated seed varieties, are selected, exchanged and conserved by farmers who want to maintain yields but are also interested in other characteristics such as taste, storability, shape, size, adaptability and appearance, as well as maintaining biodiversity. These seeds are affordable to farmers, they are locally adapted and, therefore, often best suited to the specific farmer's needs, and they do not require high-inputs of chemicals thereby causing no damage to the environment.[85]

Bioversity International/J.van de Gevel

Different varieties of sorghum.

Threats to farmers' seeds

Modern high-input large-scale monocrop farming is associated with two types of seeds: hybrid seeds and genetically modified (GM) seeds. Hybrids are produced by cross-pollinating two crop varieties to make an 'improved seed'. Although they may produce higher yields when first planted, the second generation seeds will produce low yields and unpredictable crop traits, making them unsuitable for saving and storing. This means that farmers who use hybrid seeds have to buy new seed every season and become completely dependent on the seed companies that sell them. Hybrid seeds are gradually displacing traditional and open-pollinated varieties which are inherently more genetically diverse (and therefore more adaptable to changing local conditions and the impacts of climate change).

Whereas hybrids can be produced by plant breeders in the field, genetic engineering requires complex technologies that modify genes or splice them from one species and place them inside another. GM seeds are often promoted on the basis that they could provide higher yields than traditional varieties and, therefore, help to increase farmer income and reduce hunger. But there is increasing concern that rather than increasing yields, GM in the long term actually leads to a drop in crop yields.[86] In addition, since the seeds are designed to be used in concert with expensive chemical inputs, GM crops can damage the environment as well as leading poorer farmers into spiralling debt. There is also evidence that GM crops, designed to be herbicide and insect-resistant, have actually increased overall pesticide use rather than decreased it.[87]

Corporations are actively patenting seed and crop varieties (both hybrid and GM) and pushing governments to harmonise African seed laws through plant variety protection (PVP) legal frameworks to create legally binding monopolies of the seeds they sell.[88] Farmers who buy these seeds are usually tied in through contracts that commit them to buying seeds, together with fertiliser and pesticides packages, and are unable to save or trade the seeds they have grown. The widespread use and corporate control of both GM and hybrid seeds is a threat to food sovereignty and food security and not a sustainable solution to global hunger.

But if farmers are nonetheless free to save and trade their own seeds, why do they go down the hybrid or GM seed route and sign up to binding contracts with seed companies? Pressure to buy corporate seeds comes from the market (lower seed prices and widespread availability), advertising, government advisers and extension agents, and laws that criminalise farmers who have saved seeds developed by seed companies.

In Africa, farmers' ability to freely save and trade their seeds is under increasing threat from seed companies and a variety of complex new laws. An international convention known as UPOV 1991 (from the French for International Union for the Protection of New Varieties of Plants) enables companies to claim ownership of seed varieties they have developed. By creating laws to incentivise companies to develop high-yielding and GM varieties of seeds, these laws hand over the control of seeds (and by proxy a country's food system) to corporations who are then free to exploit farmers by gradually replacing traditional seeds with a uniform and limited number of commercial seeds which cannot be saved or traded. The impact of this control of the seed system by a handful of companies would be disastrous to the lives of small-scale farmers and the biological diversity that traditional seed varieties encompass.

Case study: Kamburu, Kenya

A pioneering village in Kamburu, Kenya, has been reviving and scaling up its own seed heritage. Working with community elders who have saved the best seed varieties for many years, younger members of the community have realised the importance of seed diversity for food sovereignty in the face of climate change and an uncertain future. Strengthening local seed diversity enabled the community to withstand two years of drought and produce a surplus of food for the first time. By strengthening the resilience of a local food system, the status of women – the traditional custodians of seeds – was restored.[90]

Traditional and open-pollinated seed varieties are locally adapted and access to them is generally free from corporate control. Farmers are able to save, develop, share and sell these seeds through local markets and informal trade networks and in sub-Saharan Africa, 90% of small-scale farmers get their seeds this way.[89] These types of seeds are typical of the small-scale and biodiverse farming which still produces the bulk of the food in Africa.

Promoting the use of, and access to, diverse seed varieties, including the protection of traditional seed varieties, is essential in maintaining food security.

Community seed banks

Community seed banks (CSB) emerged about 30 years ago as a response to the loss of diversity of seeds, increasing corporate control over seeds, and the impact of natural disasters and climate change on crop production. Today there are countless seed banks around the world and some countries like India and Nepal have one hundred.[91] Seed banks perform a number of important functions.[92] They help to conserve local plant varieties, restore 'lost varieties', make seeds more accessible (usually at a lower price than commercial seeds) and increase seed sovereignty, which refers to the right for farmers to replant their own seeds, and breed, save and exchange them with others. Seed banks also create a community space where farmers can swap seeds and talk about seed varieties. Finally, seed banks can also help to create new livelihoods and income by farmers breeding and selling seeds through the bank. As the main seed selectors and savers, women are often responsible for managing community seed banks.[93]

In Ethiopia and Zambia, for example, incomes from growing plants for seed and selling them to farmers are around two to three times more than the average household income.[94] Giving farmers access to improved seed varieties can have a tremendous impact on yields. In Lude Hitosa, an area of the Oromia Region of Ethiopia, local seed co-operatives estimate that around half of households now have access to higher-yielding varieties of wheat, bean and local grain, teff seeds, through seed banks. Yields from these seeds can be up to twice as high as those that were traditionally used before.[95] Producing these higher-yielding seeds has become a way for some farmers to earn an income. Seed growers in Ethiopia and Zambia

South African 'eco-cultural calendars'

"Indigenous communities have embedded the passing on of seed, knowledge and ecological governance into their cultural practices for generations. A number of clans in the Venda region of North-Eastern South Africa are using innovative and participatory methodologies to bring forgotten knowledge and seed back into the community. By developing 'eco-cultural calendars' together, the community is able to collectively remember and restore their diversity of crops, practices and rituals, recognizing the sacredness of seed to mark every stage of growth and life. The eco-cultural calendars make the loss of diversity, knowledge and culture from past to present more visible to the community. This gives them a revived and passionate urgency to restore the cultural practices that can ensure seed diversity for the generations to come."

Teresa Anderson, former international advocacy co-ordinator, Gaia Foundation[100]

have even organised themselves into farmer-owned organisations and co-operatives to help them scale-up their activities.

Ethiopia's national seed bank has been able to return a huge number of plant varieties to communities that have lost them through a combination of drought and displacement by modern seed varieties. These seeds have been collected by working with a network of farmers and scientists across the country to help multiply as many varieties as possible of commonly grown crops like sorghum and maize. One project started in 1989 by working with 500 farmers in north Shewa and Welo regions of Ethiopia. Here farmers could distinguish over 60 traditional varieties of sorghum.[96] To maintain this crop diversity, farmers were supported in growing a number of plant varieties on their farms and then distributing the seeds to other farmers in the region who had also been affected by droughts. This participatory approach has been able to preserve a number of traditional varieties of sorghum, wheat, maize and other crops from becoming extinct. Starting with a few hundred farmers, the project has now benefited thousands of farmers across the region, and has helped to preserve and increase genetic diversity and seed sovereignty.

"People considered it a miracle when traditional varieties were brought back to their doorsteps after having been considered lost completely."

Tadesse Reta, farmer and member of Ejere community seed bank, Ethiopia[97]

In the Addaa region of Ethiopia, a similar project to create a community seed bank system was implemented in 1996 starting with twenty-five farmers.[98] Addaa was chosen as the site for a seed project because it was the region with the highest levels of fertiliser and pesticide use in the country. This dependence on external inputs made farmers doubly vulnerable both to price fluctuations for these inputs, as well as droughts and other variations in climate. A community seed bank system was created with the aim of supplying locally adapted and low-input seed varieties to farmers across the region, both for seed conservation and for food production. In 1997, heavy rainfall affected crop production for many farmers but they were able to get seeds from the community seed bank for the following year.

As a result of the seed bank system, the number of varieties being planted and conserved increased by almost 40% over a four year period.[99] As the pressure on farmers to move towards larger-scale, high-input farming increases, it is fundamental that there are projects and policies in place for farmers to protect their plant diversity and develop resilient farmer-based seed systems.

Seed choice

When farmers decide which seeds to choose they think about yield but they also think about markets, food habits, weather patterns, storage properties, taste and cooking characteristics. In the highlands of Kenya, farmers plant local maize varieties that are not as high yielding as commercial hybrid varieties,

but mature quickly and are useful as a backup source of food during times of food scarcity.[101] Yield is always an important consideration for farmers but other criteria can be just as important. This is why farmers may prefer local plant varieties with specific characteristics over modern hybrids, particularly in environments with unpredictable weather patterns. This is yet another reason to support farmers in protecting local seed diversity.

Community seed bank policy

There are only a handful of countries where the government directly supports the development of CSB. In most countries, government policy tends to emphasise the use of modern seed varieties which require chemical inputs to increase yields. Most community seed banks are set up and supported by NGOs and intergovernmental organisations. One exception to this is the Plant Genetic Resource Centre of Ethiopia which, as a government agency, helped to develop a number of community seed banks across the country.[102] For CSBs to have a wider impact they need to be scaled up to be able to reach as many farmers and farming communities as possible. In the long run, CSBs would benefit from being integrated into government agricultural development policies, such as using CSBs to store new seed varieties that are developed through participatory plant breeding, and making sure that intellectual property rights include safeguards on farmers' rights to save, use, exchange and sell farm-saved seeds.[103]

4.1.3 Water harvesting

Around one-fifth of the world's population is affected by water scarcity[104] and in Africa alone around 344 million people lack access to safe drinking water.[105] In some areas this is caused by a physical lack of water. In others, the problem is more to do with economic water scarcity: a lack of investments in the infrastructure to store and distribute water. Globally there is enough freshwater to go round, but as with many natural resources, it is both unsustainably managed (wasted, polluted) and abundant in some places (floods) while scarce in others (droughts). Water is also the site of increasing struggle as governments, financial institutions like the World Bank, and companies push for water privatisation while civil society campaigns for collective control of water as a basic human right. Water is also unevenly distributed across Africa – the Congo basin holds almost a third of the freshwater in Africa, but has only 10% of the continent's population[106] – and the current rush for land by corporations is exacerbating the problem. As the organisation GRAIN puts it: "behind every land grab is a water grab".[107]

> ***"More than one in three Africans live with water scarcity, and the continent's food supplies are set to suffer more than any other's from climate change. Building Africa's highly sophisticated and sustainable indigenous water management systems could help resolve this growing crisis, but these are the very systems being destroyed by land grabs. Advocates of the land deals and mega irrigation schemes argue that these big investments should be welcomed as an opportunity to combat hunger and poverty in the continent. But bringing in the bulldozers to plant water-intensive export crops is not and cannot be a solution to hunger and poverty. If the goal is to increase food production, then there is ample evidence that this can be most effectively done by building on the traditional water management and soil conservation systems of local communities."***
>
> **GRAIN, 2012 report[108]**

Sand dams in Kenya

A sand dam is a small dam built across a seasonal sandy riverbed which forces sand to accumulate behind the dam during the rainy season and results in water being stored as groundwater and in the sand itself. In Kenya, small-scale sand dams have helped to increase water availability for more than 100,000 people. Making water more available during the dry season has resulted in the average income of farmers living close to the dams increasing by 60%.[114]

In many African countries, harvesting and storing rainwater is an important way of ensuring that food production can continue into parts of the dry season. In Kenya, there is enough rainwater harvest potential to support six to seven times the current population, and in Ethiopia, with its population of just under 100 million, there is potential to harvest enough to more than cover the needs of over 500 million people. Across parts of the Sahel, rainwater harvesting is now carried out over hundreds of thousands of hectares, allowing huge areas of land to become agriculturally productive. Rainwater harvesting, which is when rainwater is collected and saved on-farm or directed to a small storage facility, helps to increase crop yields and ground water levels, as well as helping to develop food systems that are more resilient to climate change.

Farmers who have been able to invest in water harvesting and storage are able to grow more crops during the dry season and earn more money. In a district of central Ethiopia, known as Minjar Shenkora, farmers were able to grow onion seedlings during the dry season using water harvested into ponds, earning over US$150 per hectare, and then grow bulb onions in rainfed fields during the wet season earning, over US$1800 per hectare. Before rainwater harvesting techniques were used, onions were not grown at all due to a lack of onion seedlings in the area.[109]

One method of water harvesting is known as 'Aménagement en courbes de niveau' (ACN) or 'ridge-tillage' – a technique which helps to increase rainfall capture, storage and drainage through the

Zai pits

alina

Women sowing okra in zai holes.

The Zai pit technique originated in Mali but was adopted and modified by farmers in Burkina Faso after a particularly bad drought in 1980 which affected over one million people. The technique involves digging a series of pits roughly 20 to 40cm across by 20cm deep during the dry season. Manure is added to the pit and when the first rains arrive the pits are planted with seeds. The pits help to hold some of the surface water which comes during periods of heavy rain. They also help to protect plants and fertility from being washed away and as a result help to increase crop yields – by up to 500% in some cases.[112] Soil water conservation (SWC) techniques like Zai planting, but also stone bunds (stone walls built along contours to help slow surface water runoff) not only help to increase food yields, but they help farmers to grow plants on otherwise degraded and non-productive land. In Burkina Faso's Central Plateau, SWC techniques have helped to rehabilitate over 300,000 hectares of land.[113]

Simple drip irrigation in Ethiopia

Ethiopia is periodically affected by droughts which can affect food production and farmers' livelihoods. Drip irrigation, which works by making water drip slowly through a network of pipes directly onto the plant, can be a relatively cheap technology which can help to efficiently irrigate fields and minimise the risk of crop failure during periods of low rainfall. A small-scale drip irrigation scheme in the Dida Mega village of the Dirre district has allowed people to grow more fruits and vegetables and decreased the workload of farmers – particularly women – as well as having minimal environmental impact. The technology is able to be made from local materials and is easy to operate.[115]

sandy soils of the Sahel. A number of studies, as well as years of experience in Burkina Faso,[110] have shown that ACN can stop soil erosion and increase crop growth through increased water availability. Even during years with less rainfall, ACN has increased yields by up to 50% for staple crops like millet, sorghum and maize in Mali, Cameroon and Chad.[111]

Unfortunately, substantial water harvesting technologies require funding – which most farmers cannot afford on their own – as well as the availability of local materials. These start-up costs are one of the main limitations on the wider adoption of this useful technology.

4.2 Better ways of growing food

4.2.1 Agroforestry

> ***" 'There's no point in using manure or artificial fertilisers when you have gao trees in your fields,' says Bashir Mohamed in Droum village. 'And it's not just the area under the trees that's more fertile. The wind will blow the fallen leaves across the fields, so that increases fertility beyond the trees as well.' "***
>
> **World Agroforestry Centre, 2013 report[116]**

Agroforestry is a farming system where woody perennials (trees, shrubs, bamboos) are grown together with agricultural crops and/or animals. As a farming system it can be as productive as conventional arable crop farming.[117] The fusion of agriculture and forestry in agroforestry creates multiple benefits that can help address environmental, social and economic issues.

There are many examples of agroforestry in action in Africa. In Niger, the *Faidherbia* tree, a nitrogen-fixing acacia species, has been planted on over 4.8 million hectares of land. The leaves and pods from the tree provide fodder for animals during the dry season, while helping to protect crops from wind and water erosion and improving soil quality. This `fertiliser tree', is now being used by hundreds of thousands of farmers across Africa: it has even been described as a "fertiliser factory on the farm".[118]

Growing crops with *Faidherbia* has increased crop yields of up to 100% for maize, cotton and peanut as well as traditional grains like sorghum and millet, and yields of up to 400% in one part of Malawi.[119] Other soil-improving shrubs have been planted together with maize in Cameroon, Malawi, Tanzania, Mozambique and Zambia with total maize production increasing from a five-year average of 5 tonnes to 8 tonnes per hectare.[120]

Agroforestry with plants like *Faidherbia* help fertilise soil without the need for expensive and unsustainable chemical fertilisers. The World Agroforestry Centre has estimated that if 500,000 farmers were to plant fertiliser trees on 0.2 hectares of land, this would be equivalent to using 200 kg of chemical fertiliser per hectare which would cost farmers around US$5.8 million a year.[121]

Rural Resource Centres in Cameroon

The World Agroforestry Centre started a programme in 1998 to train farmers in rehabilitating degraded land and domestication and commercialising fruit and nut trees as an income source. These training programmes were given through Rural Resource Centres across the country where farmers could both learn new skills and contribute their knowledge. These agroforestry training centres now involve more than 10,000 farmers in over 200 communities throughout west the northwest regions of Cameroon. The programme is focused on five Rural Resource Centres which are connected to around 120 tree nurseries in local communities in the area. These nurseries provide seedlings of 'fertiliser trees' which have given farmers a new source of income: the average income from the nurseries has risen dramatically from US$145 in 2000 to $16,000 in 2003. The success of the agroforestry nurseries has resulted in other businesses taking off as well. For example, metal workers have moved to the area to produce equipment for processing tree products, and women have set up businesses to grind cassava into flour.[122]

4.2.2 Farmer-managed natural regeneration

Climate change, overgrazing and deforestation are the main causes of desertification across the world. The main driver of these is the industrial model of food production that emphasises large-scale plantations and intensive animal farming. In sub-Saharan Africa, half a billion inhabitants live in rural areas where desertification and the increasing degradation of land pose a serious threat to their livelihoods. Some African countries could face a fall in agricultural yields of up to 50% due to desertification.[124] But in some parts of Africa desertification has actually been reversed. In Southern Niger, farmers carrying out agroecological tree management practices have been able to increase ground cover and reforestation.[125]

By protecting and managing tree regrowth – a practice known as 'Farmer Managed Natural Regeneration' (FMNR) – trees have become an important part of farming enterprises since they provide fodder for livestock, firewood for cooking, help to improve soil fertility and can be a source of food. Some researchers describe this 're-greening' movement as "one of the largest-scale agro-environmental transformations in Africa".[126]

Over 5 million hectares have been 're-greened' in Southern Niger, and over 200 million trees re-established or planted which has improved soil fertility and resulted in small-scale farmers producing 500,000 tonnes of cereals more than in the past, and helping to feed an additional 2.5 million people.[127] In the Maradi region of Niger, at least 62,000 families carrying out FMNR have been able to generate additional income of up to US$23 million per year (around US$370 per family per year) by regenerating and planting around one million trees.[128] In the Zinder region of Niger, a report describes how "vast expanses of savannah devoid of vegetation in the early 1980s are now densely studded by trees, shrubs, and crops".[129] Many villages are said to have up to 20 times more trees than they did 20 years ago.[130]

FMNR can also have an impact on the environment through carbon sequestration by the trees and by helping to reduce soil erosion caused by wind and water. It can, therefore, play a part in building farmers' resilience to the future impacts of climate change.

Nicola Swann

Bananas ready to be taken to market.

Sustainable banana production in Kayunga, Uganda

In 2005, a survey by the Kayunga district local government discovered that 75% of banana farmers in four sub-counties of the district were experiencing declining yields mainly due to banana bacterial wilt (BBW). The most severely affected by these declines were women-headed households in Busaana and Wabwooko sub-counties. The reason for the spread of BBW was put down to farming practices such as poor spacing and lack of mulching. A sustainable banana management plan was developed by working with the local farmers and included integration of banana farming and other fruit trees with animals, such as goats and pigs, that could provide manure. This agroecological approach was able to reduce the effect of BBW by over 60% meaning yields were back up, food security was better, and farmers were earning more money. It also had a positive impact on soil fertility and crop diversity (with farmers growing more yams to supplement bananas), and farmers were able to exchange knowledge and share stories with other farmers in neighbouring sub-counties.[123]

Lalisa A. Duguma

Livestock grazing in a restored Ngitili system

Ngitili

Ngitili is a type of managed natural regeneration practiced in Tanzania. The word means 'enclosed fodder reserve' in Sukuma, a regional language of Tanzania. *Ngitili* refers to an enclosed area, closed to livestock during the wet season to allow the vegetation to regenerate, then opened again during the peak of the dry season. It provides fodder, firewood, timber and medicinal plants throughout the year. The *ngitili* system has had an impact on multiple fronts. There has been an increase in biodiversity, through the restoration of woodlands as the number of plant and animal species have increased. Of the 51 species of mammal which had disappeared from Meatu District, in the Simiyu Region of Tanzania, 21 species have now returned, although the return of major carnivores has caused other problems.[131] Households earn about half of their income from *ngitili*, equivalent to an additional US$1,000 per family per year, and over 64% of households get significant benefits from having *ngitili*.[132] The development of *ngitili* areas has also resulted in women spending less of their time searching for firewood and fodder, which frees them to spend more time on other tasks.

4.2.3 Conservation agriculture

"Maria Erro used to struggle to grow enough food on her half-hectare plot in Karatu district, in northern Tanzania… (her) life changed dramatically in October 2002, when she learned how to use an approach called conservation agriculture. Instead of hoeing the soil, she left the dried stalks and leaves from the previous crop on the surface. She learned how to plant maize seed directly through this mulch… Between the maize rows, she planted lablab – a legume that spreads quickly, covers the soil with a dense, leafy mat, and produces an edible seed. The lablab smothered the weeds, freeing her of the backbreaking task of weeding the plot. The lablab also fixed nitrogen in the soil, so her maize crop benefited. She harvested six bags of maize, instead of the two or three she had got in previous years… 'It was a miracle', she says, 'I will practise conservation agriculture forever.' "

FAO, 2010 report[133]

Conservation agriculture (CA) is a farming technique that requires very little digging of the soil, the use of cover crops to increase soil fertility, and reducing chemical inputs. Conservation agriculture has been hugely successful and is estimated to be spreading rapidly. Today it covers an estimated 130 million hectares globally. The benefits of CA include:

- Reduced water use due to less digging and increasing ground cover
- Cost savings due to less inputs
- Improved crop yields
- Better household nutrition and health due to more food availability
- Improved soil fertility
- Less weeds
- Less soil erosion

In Southern Africa, more than 50,000 farmers now practice CA.[134] They have been able to increase maize yields by 3–4 metric tonnes per hectare compared to conventional yields of between 0.5 and 0.7 metric tonnes per hectare. A survey of farmers in Zimbabwe showed that CA farmers had yields up to six times higher than on conventional farms as well as lower financial and labour inputs.[135] In Tanzania, farmers of Rhotia village, Karatu, using CA practices, increased maize yields from just over 1 tonne per hectare in 2004, to 7 tonnes per hectare in 2009.[136]

CA's focus on reducing soil erosion, water and nutrient loss, and increasing crop diversity makes it an invaluable tool for increasing small-scale farmer resilience. Some countries, particularly in Latin America, have made concerted efforts to encourage the adoption of CA practices. In Africa, a long-term commitment is needed from governments and agriculture development projects to support farmers in adopting CA and to carry out more research on this relatively new approach to farming. Although CA is used by both large-scale and small-scale farmers, the emphasis on reducing digging and the reduced use of chemical fertilisers makes it a positive alternative to conventional industrial agriculture.

Likoti

Likoti means 'holes' in Sesotho (one of 11 official Lesotho languages). It is used to describe a method of conservation agriculture where pits of about 30 cm in diameter by 20 cm in depth are dug and filled with organic fertiliser and seeds. The practice was introduced in Tebellong, a mountainous area of southern Lesotho, to help farmers increase their agricultural yields. Compared to conventional agriculture, *likoti* has resulted in higher crop yields, better soil fertility and soil structure, higher incomes, and greater social sustainability – since this technique is available to even the poorest villagers. Figures from 2010 estimated that over 5,000 households had adopted *likoti* taking up almost 3% of all arable land in the country, though the figure is probably higher since it includes farmers who have adopted the technique without support from farmer or development organisations.[137]

4.2.4 Organic farming

Organic farming uses crop rotations, manure and compost to improve soil fertility, and avoids using pesticides and chemical fertilisers to improve crop yields. Organic farming is a way of farming which includes many agroecological techniques such as water-harvesting, agroforestry, green manures, etc. It is also a term used to denote organic certification.

According to the International Federation of Organic Agriculture Movements, the worldwide umbrella organization, there were around 1.1 million hectares of organic land in Africa – 1% of the total agricultural area. But there are many more hectares of land where farmers basically practice organic agriculture without being certified, let alone the millions of hectares of forests which communities across Africa use to collect wild foods and medicines.

Organic certification has its advantages. It helps consumers know how a product has been produced. It also helps producers increase their income. For example, among smallholders in two counties in Kenya, organic vegetable production helped to increase people's incomes by almost 90%.[138] The down side of certified organic agriculture is that in many parts of Africa it is export driven, with smallholder farmers often producing organic food for the organic market in Europe and USA. The most widely grown organic crops in Uganda are cotton, sesame and coffee. These provide a valuable source of income for farmers, but do little to address the problem of food security and food sovereignty in Uganda. Still, for many African farmers, getting access to a high-value market through organic certification can make a huge difference to their livelihoods. True food sovereignty means prioritising local, regional and national trade above global trade which often seems the focus of organic certification efforts.

Mulching

Mulching involves covering the soil with a layer of plant material such as leaves, grass clippings, wood chips and even cardboard. It has a number of benefits including:

- Helping to prevent soil erosion – by protecting it from the action of wind and rain
- Increasing soil fertility
- Shading the soil and reducing water loss through evaporation
- Helping to keep down the weeds
- Reducing soil compaction

CDKNetwork

Sustainable banana production using mulching in Uganda

Mulching is a key technique in agroecology and is widely used by small-scale farmers around the world. In dry parts of Kenya, mulching can slightly increase the length of the growing season.[139] In the Democratic Republic of the Congo it was found that mulching could double crop production from 10 tonnes to 20 tonnes per hectare.[140] Mulched plots can also be more productive than organically fertilized plots, although combining the two produces the highest yields.

globalhort

Lettuce grown in urban garden in Dakar, Senegal

4.2.5 Homegardens

Homegardens are a form of mixed farming practiced on small plots of land usually surrounding or close to the home, and typically focused on subsistence food production. They are a popular and common form of urban agriculture and produce more than half of the fruit and vegetables consumed in a number of African cities in Burundi, Malawi, Mali, Mozambique and Zambia. Some families produce food using car tyres and boxes to grow fruits and vegetables for themselves and for sale.

In Dakar, Senegal, almost 8,000 inner-city households grow tomatoes, lettuces and cucumbers for sale and in Nairobi, Kenya, 11,000 households produce enough food in 'sack gardens' to cover the cost of their rent. In the capital of Cameroon, Yaoundé, around 35% of the residents grow traditional leafy vegetables which provide an important source of additional nutrition. Most of the urban food growers involved in homegardening are women, since the men usually work on larger commercial operations either in the city or further afield. Homegardens can also be an amazing source of biodiversity. In Ethiopia some homegardens have over 150 plant species, including a range of garden crops (bananas, lemons, coffee) and field crops (cereals, beans, root crops, herbs and spices, nuts and medicinal plants).

Resilience

Resilience is the capacity for people, their communities and the environment to face sudden changes or disasters and to recover from these shocks. Although it is an important and useful concept, it has become a buzz word in international development. FAO talks of "Resilient Livelihoods" and has developed a 'resilience strategy' which includes: institutional strengthening, developing early warning systems, protecting and building livelihoods, and improving 'preparedness for and response to crises'.[141] This concept of resilience is top heavy, speaking of creating resilience without the participation of the people that suffer the most from sudden changes and shocks. The resilience of farmers and farming communities is strengthened, above all, by supporting them to develop their own skills.

4.2.6 System of crop intensification

"Before, we used the traditional method of transplanting seedlings randomly, in a scattered fashion. Yields were not very high. Since we have been using SRI, planting seedlings in a grid-system, we can control weeds effectively. We now have a stable income and live in better conditions. We have enough money to educate our families and to pay for health services. This method, as well as planting in the off season, has brought us a happy life. Some have built modern houses; others have bought phones or bicycles."

Madame Berthine, a small-scale farmer in Ambositra, Madagascar[142]

The System of Crop Intensification (SCI) is an agroecological technique that aims to promote plant growth and increase crop yields by reducing planting density and improving the quality and condition of soil. Additional benefits of the technique include a large decrease in the use of seeds (80 to 90%), reductions in the use of chemical fertilisers, and reductions in water use for crop irrigation. SCI emerged from the System of Rice Intensification (SRI) which was developed in the 1980s and 1990s in Madagascar and eventually spread to other parts of the world. The principles, which were originally applied to irrigated rice paddies have been applied to other crops including wheat, maize, millet, teff, turmeric, legumes and vegetables. Although SCI generally requires more labour input, the significant yield increases tend to more than compensate for this, as farmers are able to earn more money with the same amount of land. It should be noted that many farmers still make some use of chemical fertilisers, in combination with organic fertilisers, although SRI helps farmers reduce chemical fertiliser input and some farmers practice SRI with organic fertilisers alone.[143]

In Ethiopia, the government's Agricultural Transformation Agency applied the SCI concepts to the production of teff. In one trial involving 160,000 farmers, average yields increased by 70% during the 2012 to 2013 growing season. In another trial with 7,000 farmers, a more labour intensive version of SCI was used which involved transplanting seedlings; this led to an increase in yield of up to 300% compared to previously, and up to 90% reductions in the use of seeds.[144] The techniques have also been applied to finger millet. One farmer in the Tigray province produced over five times more millet using SCI than normal techniques of broadcasting seeds by hand.[145] The technique has been so successful that the Ethiopian government has decided to scale up the trials to cover over 1 million hectares in the 2013–14 growing period, and potentially up to 2.5 million hectares the year after.[146]

In Mali, SCI has been applied to wheat production and yields have increased almost three-fold compared to conventional practice.[147] Even during years of drought, or when irrigation water was in limited supply, wheat grown with SCI consistently outperformed wheat on conventional plots. A series of SRI field trials found an increase of around 34% in yields when using SRI techniques such as lower planting densities, less chemical fertiliser and more focused irrigation.[148] Overall income more than doubled compared to conventional rice growing systems and despite increased costs, due to more labour and organic fertiliser purchases, the higher yields were able to cover this.

As well as increased income, farmers using SRI were able to use less seeds: roughly 6 kilograms of rice seeds per hectare instead of up to 60 kg normally used. This also means that farmers have more seed left for household consumption.[149] The technology required for SCI farming is also fairly simple. For example, a hand-operated weeder can help with weed control and animal manure can be used as fertiliser. These sorts of technologies can easily be obtained locally (eg. manure from a nearby farm) and mean that farming communities do not have to rely on expensive imported products or equipment.

Using SCI means that farmers can typically more than double their yields, and despite increased labour demands and the cost of using organic fertilisers, this means that farmers are able to more than double their incomes.[150]

ICRISAT / C. Wangari

A group of women farmer involved in a participatory plant breeding process to improve finger millet varieties.

4.3 Better ways of learning

4.3.1 Participatory plant breeding

Participatory Plant Breeding (PPB) is a decentralised and participatory approach to breeding and creating different types of plants. Researchers and farmers work together to create varieties of plants that are better adapted to local soils and weather patterns. This collaboration between researchers and farmers can help to speed up the development of new varieties from 10–15 year to 5–7 years.

In PPB, farmers take the lead in selecting varieties of plants that might be worth breeding and improving. They also take the lead in growing and distributing new types of seed to other farmers. PPB helps to empower farmers and gives them more control over the development of plant varieties and, therefore, control over their livelihood. Since women always play such an important part in preserving and planting seeds, they stand to gain the most from PPB approaches.

Corporate-controlled seed breeding programmes, led by companies like Monsanto and Syngenta, are designed to serve large-scale, corporate farming rather than small-scale farmers. Using genetic engineering and hybridisation techniques the seeds they breed usually require chemical inputs and prevent farmers from saving their seeds. Using PPB, farmers are empowered to take control of the seed development process and breed seeds which they can trade, save and continue to improve. By involving farmers in the development of seeds, the final products are more likely to be well adapted to the local environment of farmers and their specific needs.

In Uganda, 500 farmers decided that instead of continuing to rely on food aid, they would replicate a mosaic virus-resistant variety of cassava which they got from a local research station.[151] By selectively breeding this new variety of cassava, farmers were able to produce six times as much cassava as usual. With the support of the Nakasongola District Farmers Association, the farmers set up processing facilities

to turn some of the cassava into chipped cassava and flour. As a result, for every dollar the farmers had invested in the breeding programme and value-adding facilities, they received 19 dollars in return.

PPB leads to an increase in the diversity of plant varieties. In Egypt, participatory barley breeding projects have led to at least six new barley varieties being multiplied and shared across the north-west coast of the country. In Eritrea, PPB has led to three new varieties of barley and one new lentil variety being multiplied across the country by farmers.[152]

> ***"PPB empowers small farmers and validates the logic behind their choices. It gives the farmers a greater measure of control over their livelihood, and for those living at or near subsistence level it provides the opportunity to break out of the cycle of poverty. Perhaps no group benefits more from the PPB approach than poor rural women. It is the women who provide much of the farm labour, process and store grains and other crops, and prepare the food. Because in many places they also preserve the best seed for planting, they play a key role in managing plant genetic resources."***[153]
>
> **Ronnie Vernoy, Genetic Resources Policy Specialist, Bioversity International**

There is a real need for more state support of PPB programmes which can be integrated with local community organisations and community seed banks. This would lead to more effective, sustainable and locally-adapted improvements to seed varieties.

4.3.2 Farmer Field Schools

Farmer Field Schools (FFS) are an educational forum for farmers to learn and share practical knowledge related to farming based on a central learning garden. Compared to industrial agriculture – which creates fewer jobs and treats individuals as wage labourers rather than innovative producers – farmer field schools emerged from small-scale farmers' interest in learning and sharing skills at a local level.

The approach was first used in Kenya in 1995 and has since spread across Africa (and other parts of the world). To date, an estimated 12 million farmers around the world have had some form of training through a FFS.[154] The impacts of FFS have been considerable, ranging from increasing food production (by anything from 50% and 85%), to increasing access and control over food production by women and children.[155]

In the Rwenzori region of Uganda, what started as a FFS with a central learning garden, has evolved into Farmer Family Learning Groups (FFLG),[156] where farmers learn and support different farms each time they gather for a visit. Around 100 FFLGs have worked with over 1,000 households and successfully helped to improve food security, income, biodiversity and the resilience of the farming systems to adapt to climate change:

> ***"FFLG members work together and thereby reduce labour costs. They open more land than when working alone. Due to proper and timely management practices, productivity has increased. The selection of commercial enterprises based on group decisions helps***

Bustani ya Tushikamane – Garden of Solidarity

Bustani ya Tushikamane **(ByT) is a farmer training centre for sustainable agriculture based in Morogoro, Tanzania. The project is run by Sustainable Agriculture Tanzania and co-ordinated by Janet Maro, an agronomist and active participant in Tanzania's food sovereignty movement. The centre has a demonstration farm, where farmers learn about agroecology and organic food production through practical training sessions, as well as an information centre. In 2013 the project supported 2700 farmers through trainings, 46% of whom were female, and a further 833 farmers through the information centre. ByT has started to develop Farmer Field Schools in rural areas to disseminate sustainable farming techniques more directly and allow farmers to share knowledge.**

planning for larger quantities to be marketed as a group. In addition to crops that double as both food and cash crops, the purely cash crops grown are coffee, cocoa, and cotton. All FFLGs have established savings and credit schemes. Most groups have increased their minimum total savings from a mere US$1 to around US$3,000. All this has been made possible by the social trust and interaction which enables farmers to access better markets through group marketing."[157]

In Mozambique, of the 80 farmers involved with one FFS, almost all of them modified the spacing between plants to increase overall yield, and 80% reduced their use of chemical pesticides in favour of biological methods of pest control.[158] The FFS approach, which emphasises farmer experimentation and individual empowerment, resulted in almost three-quarters of farmers trying to solve their problems autonomously.[159]

Beyond learning new skills and increasing crop production, one of the main impacts of FFS is empowering farmers to develop innovative and sustainable solutions to their problems rather than simply using technical solutions.[160] There is some evidence that smaller scale FFS programmes are more effective than larger or national scale programmes. For example, a review of small-scale FFS projects showed that there was improved knowledge, adoption of useful farming practices, and that production and yields increased. Larger scale or national FFS programmes, however, suffered from difficulty in training enough facilitators and lack of support from local communities.[161]

4.3.3 Farmer-led innovation

Farmer-led innovation is one of the keys to increasing food yields and improving the long-term sustainability of our food system. Top-down, technology-driven innovation has contributed to large increases in crop yields in the past, but these increases have slowed and come at a high cost. Farmer-led innovation, which prioritises the knowledge farmers have of their local environment, can have a significant impact on food yields and food sovereignty. For example, farmers are often best suited to identifying and developing plant varieties adapted to deal with the impacts of climate change and plant diseases. It is also important that farmers and scientists collaborate on research work.

An Ethiopian innovator

Mawcha is a 40-year-old head of a household with two children and has a farm of about one hectare in Adua District of Central Tigray. Mawcha suffered frequent flooding and deposition of silt and stones on her fields. In 1986, without outside assistance and using her own labour, she started to build terraces on the hillside to control the runoff. She then enclosed the hillside to allow natural regeneration of the vegetation; she was the first woman farmer in the area to do this. The hillside is now forested, and the terrace edges have a grass cover. She harvests fuelwood for home use and sale from the enclosed hillside, where she practises controlled grazing and cut-and-carry feeding.

She was motivated to innovate by adverse circumstances. When her husband was resettled in southern Ethiopia, she remained behind. She did not get on well with her husband's relatives, who questioned her right to retain the land and house. Because of this conflict, she decided to be independent and to plough on her own. She is now ploughing the land of some male farmers in return for straw for her animals. She is proud that these men regard her as a better farmer than men in the same community who own oxen, and therefore prefer to sharecrop with her.

Mawcha is eager to share information with other farmers in her area. She formed a group of female heads of household and encouraged them to plough their own land. The impacts of Mawcha's innovations are highly visible. She used to be regarded as poor because she had to buy grain from the market. Now she produces enough food for the entire year. She exchanges branches of trees from her enclosed hillside for straw to use as animal feed.[162]

5. Benefits of agroecology

People generally understand and like the idea of sustainable agriculture – producing food without expensive and unsustainable inputs like chemical fertilisers and pesticides. But they argue that sustainable agriculture can't produce as much food as industrial agriculture, and with our increasing global population, we need to increase food production as much as possible. There are multiple problems with this argument. The first is that there is plenty of evidence that there is enough food to feed the global population[163] – the real problem is access to and distribution of this food. The second problem is that agroecology can increase crop yields.

The evidence shows that agroecology and small-scale, sustainable farming can produce as much food, and often more, as industrial farming, as well as offer employment opportunities, support people's livelihoods by increasing income, increase biodiversity, have a positive impact on the gender issues, help with climate change mitigation, and produce nutritious food. Agroecology recognises that agriculture is multifunctional, a concept which is described by the International Assessment of Agricultural Science and Technology for Development (IAASTD) as: "a multi-output activity producing not only commodities (food, feed, fibres, agrofuels, medicinal products and ornamentals), but also non-commodity outputs such as environmental services, landscape amenities and cultural heritages."[164]

5.1 Increasing yields

The largest study to date comparing organic with conventional farming systems found that yields from organic farming could be as little as 8% lower than yields from conventional farming if techniques like multicropping and crop rotation were used.[165] For some crops, such as oats, tomatoes and apples, there were no yield differences between the two systems. The study also found that many previous studies are biased and report higher yields from conventional compared to organic farming than are actually the case.

Another study, which used data from 57 developing countries, showed that farmers switching to sustainable methods on average increased their yields by 73%.[166] For farmers growing root crops (potato, sweet potato and cassava), switching to sustainable farming increased yields by around 150%. Poorer farmers who switched to sustainable methods tended to benefit the most.

An analysis of 40 agroecological projects, covering almost 13 million hectares in twenty African countries, showed that crop yields more than doubled as a result of agroecological approaches, with additional benefits in terms of carbon sequestration, reductions in pesticide use and soil erosion.[167]

A study of organic production in tropical Africa showed that organic conversion leads to significantly higher yields than conventional farming.[168] Research by the UN showed that switching to agroecological farming methods has increased yields across Africa by 116% and by 128% in East Africa compared to conventional farming.[169]

There is mounting evidence that agroecology can increase yields across a range of farming approaches. Whether practicing System of Rice Intensification techniques, agroforestry or rice-duck farming:[173]

> ***"Thousands of projects throughout Africa, Asia and Latin America show convincingly that agroecology provides the scientific, technological and methodological basis to assist small holder farmers enhance crop production in a sustainable and resilient manner thus allowing them to provide for current and future food needs. Agroecological methods produce more food on less land, using less energy, less water while enhancing the natural resource base, providing ecological services and lowering outputs of greenhouse gases."***
>
> **Miguel Altieri, Professor of Agroecology at the University of California, Berkeley, USA[174]**

Case study of Tigray: increasing yields with composting

The Tigray project is a sustainable development project that started in Tigray, northern Ethiopia, in 1996. The focus of the project is community-based land management and rehabilitation to improve crop production and the livelihoods of local farmers. Originally this was done by offering farmers a 'basket of choices' of trainings that they could be involved with as an entry point for the project. These included making and using compost, planting multipurpose trees, water harvesting and building ponds. When researchers examined the difference between using composting and chemical fertiliser on plots over a number of years, they discovered that average yields on composted plots were as good as, or higher than, those which used chemical fertilisers.[170]

Apart from field pea, the application of compost generally doubled the yield of grain compared to conventionally grown methods, and composted fields consistently produced higher yields than fields treated with chemical fertiliser.[171] Another effect of the Tigray project was that farmers who previously only grew wheat, barley and the local grain, teff, are now growing maize and beans as part of a mixed farming system. Agricultural biodiversity in the area increased, and due to the regular addition of compost, the fertility and quality of the soil farmers were working with also improved. Another advantage of compost is that it only needs to be applied once every few years (compared to chemical fertiliser which needs to be applied yearly), which has meant that many farmers have been able to get out of debt caused by buying expensive chemical fertilisers.[172]

5.2 Reducing the gender gap

"It is women that hold the key to tackling hunger and malnutrition. Yet their needs are often not recognised or understood."

Sandra Kabati, a small-scale farmer from Mangambwa Village, Senanga District - Zambia[175]

"In many African countries women are major producers of food and the ones who sustain households and communities, yet their role is not always recognised. Despite all their efforts, women remain poor and voiceless. Rural women still face many constraints and problems. For example, as far as land ownership is concerned, women's rights to land are usually limited by cultural practices. Women also do not have power to influence agriculture policy decisions."

Mercia Andrews, convenor of the South African branch of the Rural Women's Assembly, a regional network of rural women[176]

There is a widely acknowledged gender gap in agriculture. Women farmers carry out around 70% of the agricultural labour.[177] They also carry out most of the food preparation, and the sourcing of water and fuel wood, essential for household food consumption.[178] They do, on average, around 90% of the weeding and hoeing on agricultural land, as well as 60% of the harvesting and marketing of produce and products.[179] Also, due to their limited access to land, they tend to grow a higher diversity of crops, thereby contributing to increased biodiversity.[180] And yet the significant role that women play in food production is often ignored or not considered by policy makers.

This is partly due to land tenure arrangements which tend to benefit men who have more control over land. In a survey of 16 African countries, only 2% of women had land titles.[181] As a result, men tend to have more access to agricultural inputs, investments, and extension services (eg. training, advice).

The Tallib Women's Association and gum arabic production in Sudan

The Women's Gum Arabic Association was established in 2009 in the village of Tallib, in North Kordofan State, Sudan, with 80 women who collectively own 350 acres of land with acacia trees. A few years later small-scale producers of gum arabic suffered as prices fell and producers retained only a small percentage of the export price. In some areas acacia trees were cleared by farmers to make room for other cash crops. Through a microcredit scheme the women in the association were able to double their yields, secure more income, and improve their lives. This financial support enabled women to develop their business despite the job of gum tapping being traditionally carried out by men. The association itself has been able to become a small independent microfinance unit itself and is able to support other small farmers in the area that are unable to get loans from traditional institutions.[193]

The United Nations estimates that if women had the same access to agricultural resources as men, they would be able to increase output on their farms by 20–30%, raising total agricultural production by up to 4% worldwide and reducing the number of hungry people in the world by up to 17%.[182] This may be because women have, in some cases, been found to manage resources, such as organic fertiliser and credit, better than men.[183]

Land grabs have a disproportionately negative impact on women compared to men. This is because women carry out more of the agricultural work, as well as the household tasks and caring for children and the sick, while men tend to be more involved in the negotiation process with companies planning to buy or lease land:

> ***"It is the woman who is affected most because she is the main producer of food for the household. The woman is feeding the household. We normally used to go there*** **(to former community land on which the biofuel company is now growing Jatropha)** ***for farming and collecting firewood. Now we cannot go. They are prohibiting it. Now I have to go to another forest. This is a little bit far away. It is now harder work for me to go compared to the other area. Because of this I can spend less time on my farm because the work time has been reduced."***[184]

It is therefore essential that any efforts to address the problems of land grabs and land rights in Africa deal explicitly with the impacts that land grabs and agricultural development projects may have on women and women's land rights.

Corporate agriculture tends to fail women. Corporate investors have been found to favour employing men over women, and women working for large agribusinesses tend to get less secure employment.[185] In Kenya and Senegal, evidence shows that women are often excluded from contract farming because of their lack of statutory rights over farm land.[186]

How are women benefiting from agroecology? One example is through Farmer Managed Natural Regeneration (FMNR), described above, which has had a significant impact on the availability of fuel, wood and water. In Burkina Faso, for example, women have benefitted from this improved supply as it has freed them to grow groundnuts as a cash crop and earn on average US$210 more annually by selling tree-based products, such as the leaves of baobab, flowers of kapok and fruits of the shea and locust bean.[187] The evidence shows that FMNR puts women in a stronger economic and social position making them able to feed their families with a more nutritious and diverse diet.[188]

In Niger, women who were traditionally excluded from access to resources have gained responsibilities associated with FMNR: there are now trees to tend while the men migrate during the dry season. Trees which provide firewood and leaves are a useful source of income which women can sell while investing in goats, sheep and other plants.[189]

Women play a fundamental role in selecting, storing and distributing seeds, and are therefore key to the success of community seed banks (CSB) and local plant breeding.[190] Since women often have responsibilities related to the planting, harvest, storage and cooking of specific plants,

Bioversity International

Peninah Mwangangi. farmer and member of the Kyanika Women Group in Kitui, eastern Kenya, holding a sorghum seed head.

CSBs are a powerful way of supporting and valuing women's knowledge. In West Africa, CSBs have been established which include crops that women are often responsible for producing like okra, hibiscus, Bambara groundnut and cowpea.[191]

As an important element of agroecology, CSBs can therefore help to focus local food systems on women's needs as food producers and support women in addressing the gender imbalance that is so widespread across the world.[192]

We are the Solution: a rural women's campaign for food sovereignty

'We are the Solution' is a food sovereignty and food justice campaign led by African female farmers. The campaign is co-ordinated by Fahamu, a network for social justice. It focuses on research, knowledge-exchange and capacity-building in West Africa by supporting rural women and their farming associations to promote and share agroecological knowledge and practices:

"A dynamic network has grown between rural women and their associations in West Africa through their participation in the We Are the Solution campaign. Through the network, not only are WAS members exchanging ideas and sharing experiences about WAS activities but they have organically begun to share their success, difficulties, achievement and ideas more broadly. It is through this network and the building of a common agenda that WAS campaign members and many more women in rural West Africa are beginning to create a vibrant movement for change."

Fahamu, Networks for Social Justice, 2014[194]

5.3 Increasing employment and income

Agriculture now employs about 60% of Africa's population, but the figure is likely to continue to fall given current speeds of rural to urban migration:[195] 40% of African people live in urban areas at the moment but the figure is projected to be more than 50% by 2030. And yet urban areas depend entirely on the food produced in rural areas and will continue to do so in the future. Because of this, it is critical that opportunities for employment in rural areas are developed and the livelihoods of smallholder farmers are supported.

Small-scale producers are the cornerstones of local and sustainable food systems and although there is a pervasive myth that large-scale farms are more efficient and productive than smaller ones, smaller farms usually cost less to run: labour on small farms tends to be cheaper (ie. badly paid) than the cost of machinery on larger farms.[196] Because smaller farms are usually less mechanised, they tend to employ more people per hectare than industrial farms. Farmers are also more likely to have control over their resources and livelihood on a small farm compared to working as labourers on larger farms and plantations. Therefore, investing in small-scale agroecological farming can have an important impact on protecting and creating jobs, but also on giving farmers more control over their lives.

The United Nations estimates that by `greening agriculture', 47 million jobs over the next 40 years could be created.[197] By `greening', the UN means transforming agriculture into productive sustainable farming that restores soil fertility, reduces soil erosion, reduces chemical inputs, and reduces food spoilage and waste. This is similar to the principles of organic farming except that "the highly efficient and precise use of inorganic fertilisers, pest controls and technological solutions may also be included in the broad spectrum of sustainable farming practices".[198]

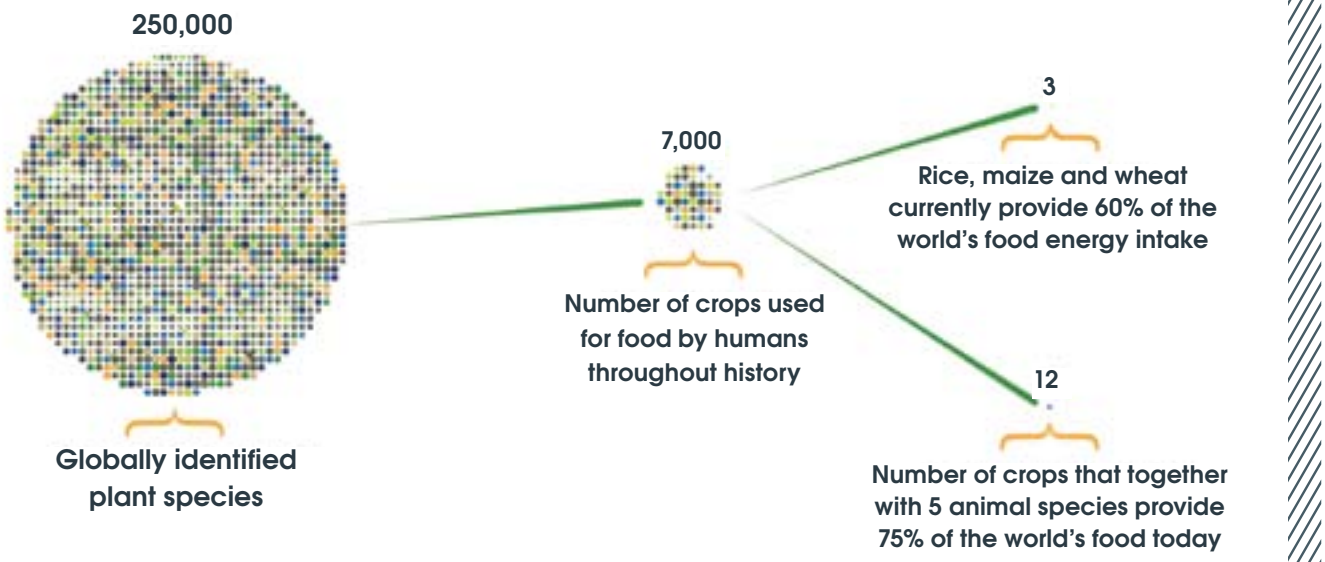
A joint United Nations Environment Programme and United Nations Conference on Trade and Development report on organic agriculture in Africa presents a number of case studies that show how agroecological methods can transform the lives and livelihoods of farmers.[199] The report presents a total of 15 case studies which are all related to helping farmers adopt sustainable farming techniques. These range from supporting cotton farmers in Uganda switching to organic methods to training farmers in Kenya in push-pull pest management techniques. Thirteen of these case studies led to increased incomes for farmers. One example is the Sustainable Agriculture Community Development Programme in Kenya which has worked with over 30,000 smallholder farmers over a period of 13 years, and has been training farmers in a range of agroecological techniques, including soil fertility management, water conservation and seed saving. Farmers involved with the programme have been able to increase income by 40%. This has allowed farmers to cover the costs of basic needs such as school fees and medical costs.[200]

The Alliance for Food Sovereignty in Africa (AFSA) has been collecting case studies to help create an evidence base for agroecology. One of these case studies relates to the Kotoba Sustainable Livelihoods Project in Ethiopia. By using participatory learning approaches to share agroecological knowledge and techniques, the project has been successful at significantly increasing farmers' income.[201] Over a period of four years, the income of both male and female-headed households increased thirteen-fold (from an average annual income of around US$35 to US$481). Some of this increase was due to more productive varieties of barley and the use of compost.

A Greenpeace study carried out in Kenya and Malawi compared the incomes of farmers using agroecological methods with farmers using chemical fertilisers and pesticides. Farmers in Kenya using push-pull technology were able to earn three times more income than farmers using chemical pesticides.[202] Farmers in Malawi were able to earn almost 60% more income by growing maize using agroforestry for organic fertilisation compared to farmers who used chemical fertilisers.[203]

Of course income alone is not the only thing that matters to a farmer. Health (including water) and education are also essential to farmers and can and should be provided by the state. Other basic needs should be affordable, sustainable and, in some cases (eg. energy), publicly and community owned.

Figure 2: **Over reliance on a small range of crops puts future food and nutrition security at risk.**[207]



Based on image from Bioversity International, *Research for our future* 2012

5.4 Increasing agricultural biodiversity

"Biodiversity for food and agriculture (agricultural biodiversity) is the sub-set of biodiversity developed by or co-evolving with people in all types of environments on land above and below ground, in inland waters and in the sea. It embraces not only all species harvested by people but also the support species – e.g. pollinators, predators, soil microorganisms and the ecosystem functions provided by these species – which enable the harvested species to flourish."

Patrick Mulvany and Dunja Mijatovic[204]

"I used to see 30 types of bean in the market, but now I only see two."

Ugandan farmer[205]

The Food and Agriculture Organisation estimates that up to 75% of plant varieties were lost in the last century.[206] It also predicts that almost a quarter of the non-domesticated or wild relatives of our main food crops – potatoes, beans, peanuts – will be lost by the middle of this century due to our rapidly changing climate. The most important drivers of losses of agricultural biodiversity are the destruction and degradation of natural habitat through deforestation, large-scale agriculture and urbanisation. Part of the loss of biodiversity is due to the trend of monocropping a limited variety of plants that was characteristic of the Green Revolution. In Asia, over 40% of farms adopted Green Revolution high yielding varieties (HYV) within only 15 years of their introduction. As a result, an estimated 1,500 local rice varieties have been lost in Indonesia during the same period.

Agricultural biodiversity matters because lesser known plants can hold the key to future food production. Plants that are resistant to heat, drought, salt, pests and low soil fertility can help farmers to grow food in spite of difficult conditions. Growing a wide range of plants helps to insulate smallholder farmers from sudden weather changes or the arrival of new – or old – crop diseases, as well as unpredictable social, political and economic circumstances. Agricultural biodiversity is one of the keys to a resilient food system.

The type of farming system used to produce food can have a huge impact on biodiversity. For example, organic farms' systems can have up to 30% more species on them than conventional

farms, which tend to grow single crop varieties over large spaces, reducing diversity.[208] In Africa, 33 million small farms, making up around 80% of all farms on the continent, produce 90% of the agricultural output from the region.[209] Many of these are mixed farms with a high level of crop diversity. This diversity contributes to people's nutrition and health, and helps to create more resilient sources of income and ecological sustainability. Farming systems that favour polyculture (growing multiple crops in the same area) over monoculture (typical of industrial farming) can produce higher yields, reduce pests (and therefore the need for pesticides), enhance pollination services, increase carbon sequestration and help prevent soil erosion (due to continuous crop cover).[210]

In Malawi, intercropping maize with the nitrogen-fixing tree, gliricidia, helps to improve soil fertility and maize yields without the need for expensive chemical fertilisers.[211] A ten-year trial of maize grown with gliridicia in Malawi produced a yearly average of five tonnes of maize per hectare compared to an average of one tonne on control plots which had no gliricidia or chemical fertiliser.[212]

Intercropped fields are also able to hold about 50% more water up to two weeks after rainfall than fields planted with a conventional maize monoculture – an extremely useful quality in an area with increasingly unpredictable rainfall patterns. In Ethiopia, farmers grow a number of maize varieties in the same fields as a means of insurance in case of drought. Some of these varieties are more productive than others, depending on the weather each year. Fields with mixed maize cultivation have been shown to produce up to 30% more maize than fields with a single variety even in normal rainfall years, with up to 60% more maize produced during dry years.[213] Traditional farming systems in Ethiopia have been documented to use over 100 different crop species. Despite this incredible diversity, much of the focus on food production in Africa has been on maize, rice and wheat, with fewer resources invested in sorghum, millet or any of the other wide range of crop species that make up a typical African farmer's homegarden or field.[214] The reasons for this bias are complex but include the influence of government subsidies, food cultures and taste preferences, and the cost of processing (the cost of new equipment can be a limiting factor for the take up of less common grains).

5.5 Improving health and nutrition

Today, crops like wheat, rice, maize, potatoes and sugar make up the bulk of most people's diet.[215] Meanwhile the production of less commonly consumed crops such as millet, rye, yams, sweet potatoes and cassava has declined. This decline in crop diversity has made people more dependent on a narrow range of plants for their own food security and nutrition as well as creating a less resilient food system.[216] In Africa, the increasing emphasis on high-value, export-oriented monocrop production can lead to increased food insecurity (since uniform crops suffer greater damage from pests and diseases) and the loss of diversity, which in turn is linked to poorer nutrition.[217] Diversity is intrinsically linked to people's health and nutrition.

A large-scale survey in 21 African countries found a statistically significant relationship between the nutritional quality of children's diets (dietary diversity and fruit and vegetable consumption) and the amount of tree cover in the area.[218] The study shows that people's diets are healthier (include more fruit and vegetables) when there is more tree cover in their local area. A similar study in Malawi showed that when there is more farm production diversity, there is also more dietary diversity – a key indicator of health and nutrition.[219]

Many agroecological practices are especially good at strengthening the resilience of farms and local food systems. A recent study showed that organic farms have around 34% more plant, insect and animal species on them than conventional farms.[220] Small-scale farms also tend to be more diverse, making use of polyculture and multiple cropping techniques to maximise food yields and increase food security.[221] Increased yields can also lead to an increased income and better livelihoods which, in turn, leads to an improved diet. Because of both of these direct and indirect benefits of agroecology, small-scale sustainable farms are the key to providing households across Africa with a nutritionally adequate diet.[222]

The Soils, Food and Healthy Communities Project, a participatory agriculture and nutrition program in northern Malawi, was able to improve child health, crop diversity and food security by using sustainable agriculture techniques combined

Rachel Bezner-Kerr

SFHC Project field visit to a groundnut and pigeon pea field in northern Malawi.

with education.[223] Farmers were encouraged to grow legumes such as pigeonpea and groundnut, together with other plants, both as a means of improving soil cover and fertility, as well as providing a more diverse and healthy diet. Nutrition education was given using a 'transformational educational approach' with discussion groups which emphasised dialogue and the importance of local knowledge. Over a six-year period there was a significant increase in child growth figures and dietary diversity for households involved in the project compared to non-participating households.

In the Upper East Region of northern Ghana, a project focused on popularising a Vitamin A-rich orange-fleshed sweet potato, has been able to encourage farmers to grow this plant on marginal land.[224] This variety of sweet potato is drought-resistant, which has been an important quality given the late and inconsistent rainfall in northern Ghana. The 50 smallholders involved in this trial found that their orange-fleshed sweet potato yields were double that of normal sweet potatoes, had helped them during the 'hunger period' (six months before harvesting millet), and that they had been able to sell surplus produce for extra income. They are also able to propagate their own sweet potatoes from cuttings, which means they do not need to buy seeds from large companies each year. This approach provides a cost-effective and sustainable way of tackling Vitamin A deficiency while improving people's food sovereignty and security. The nutritional benefits of the orange-fleshed sweet potato have also been researched by the Uganda National Sweet Potato Program which has distributed several varieties among farmers with the aim of combating Vitamin A deficiency.[225]

John Hogg / World Bank

Farm land bordering an industrial area

5.6 Addressing climate change

The global food system, which includes agricultural production, fertiliser production and food storage, is responsible for around a third of all greenhouse gases emitted globally. Agriculture, and the food sector as a whole, is, therefore, one of the main drivers of climate change. The livestock sector alone is responsible for almost 15% of global greenhouse gas emissions emitted annually.[226] The food sector as a whole (production, processing, transporting and consuming food) accounts for 30% of global energy consumption and industrial agriculture in particular, is totally dependent on fossil fuels, both as fuel for machinery, transport and fertiliser production, as well as petroleum-based pesticides and herbicides. It is also one of the main victims of climate change.

Africa's farming systems are extremely vulnerable to the effects of climate change. 98% of sub-Saharan agriculture is rainfed and, therefore, exposed to the impacts of climate variability, droughts and floods. The Intergovernmental Panel on Climate Change's Fifth Assessment Report states that "agriculture in Africa will face significant challenges in adapting to climate changes projected to occur by mid-century, as negative effects of high temperatures become increasingly prominent".[227] The report states that climate change will have an impact on water availability, which will, in turn, reduce cereal crop productivity leading to a significant impact on food security. It also points out that agroecological practices, such as agroforestry, FMNR, mulching and conservation agriculture, are practices that "strengthen resilience of the land base to extreme events and broaden sources of livelihoods, both of which have strongly positive implications for climate risk management and adaptation".[228]

Agroecological practices can help to reduce the impacts of climate change. Crop rotation, improved grazing, cropland and manure management, maintaining and restoring the fertility of soils, conserving energy and water use and year-round crop cover can all help to sequester carbon dioxide and reduce agriculture's greenhouse gas (GHG) emissions and its impact on the environment.[229] Organic farming systems can sequester more carbon dioxide than industrial farms, and sustainable farming in general tends to require fewer carbon intensive external inputs

(such as chemical fertilisers).[230] It has also been shown that soils managed using organic methods can hold water better and produce more yields than conventional farming systems in conditions of drought or heavy rainfall.[231]

The FAO report on 'Low Greenhouse Gas Agriculture' outlines two scenarios based on a certain proportion of conventional farms converting to organic farming. This conversion could potentially mitigate between 40 and 65% of the world's GHG emissions from agriculture.[232]

Agroforestry has been shown to help reduce farmers' exposure to climate-related risks. Planting 'fertiliser trees' can help the soil retain moisture during droughts, as well as providing additional income through firewood and offering a less risky investment than chemical fertilisers in the event of crop failure.[233] In western Kenya, agroforestry has benefited women in particular who have access to a stable source of cooking fuel and income from firewood which has been shown to help reduce their vulnerability to climate change.[234]

Small-scale farmers and agroecological practices also play a central role in conserving crop diversity, and developing varieties of plants which are adapted to a range of weather conditions including droughts. In 2010, a drought in Guangxi, in south-west China, destroyed many of the modern crop varieties (hybrids) while the better adapted traditional varieties (improved landraces and open pollen varieties), such as drought and wind resistant maize, were able to survive.[235] Furthermore, villages involved in Participatory Plant Breeding programmes were able to recover better after the drought because they had more of their own seed varieties, whereas other villages, which had in the past grown hybrid seeds, struggled due to a shortage of hybrid seeds on the commercial market. When the 2009 hurricane in West Bengal turned large amounts of farm land into salty ponds, only a handful of farmers were still preserving salt-tolerant varieties of rice on their farms. Even the most high-yielding modern varieties of rice were useless on salty soil; it was the traditional rice varieties that were needed.[236]

In Kenya, the Mijikenda people adopted many improved crop varieties during the Green Revolution while continuing to plant traditional variants of important crops like maize, millet and cassava. Due to the impact of climate change, many farmers have returned to their traditional varieties and are planting different varieties together to reduce the risk of crop failure.[237] Instead of planting a modern hybrid variety, they now mix maize varieties like *mingawa* (which matures with extended rainfall), *mzihana* (matures with medium rains) and *kastoo* (more drought-resistant). By doing this farmers have made themselves more resilient to the impact of climate change, more independent of commercial seed breeders, and can avoid using expensive chemical inputs which are required with modern hybrid seeds.[238]

In South Africa, research has shown that farmers have already started noticing seasonal temperature changes, which predict drought, and begun adapting pre-emptively by planting short-season and faster growing crops, as well as planting more drought-resistant crop varieties, increasing irrigation and planting trees to help mitigate the effects of climate change.[239]

Locally developed varieties of rice in West Africa, in countries such as Ghana, Guinea Bissau, Sierra Leone and Togo, have been shown to be extremely adaptable and 'robust' because they have been bred over generations specifically to cope with difficult ecological and social conditions.[240] These 'farmer rice varieties' are often more productive than imported varieties of rice, can grow with less inputs than modern varieties and require less maintenance.[241]

Further afield, researchers have shown how farms based on agroecological principles can be more resilient to the impacts of natural disasters like hurricanes. A survey carried out in 360 communities across Nicaragua, Honduras and Guatemala after Hurricane Mitch in 1998, showed that farms that had used sustainable agriculture methods had suffered considerably less damage than conventional farms. Sustainable farms had up to 40% more topsoil and had suffered less economic loss than neighbouring conventional farms.[242] In Chiapas, Mexico, coffee-based farms which had more plant diversity had also suffered less damage from Hurricane Stan in 2005 than more conventional plantations.[243] In Cuba in 2008, monoculture farms suffered greater losses (95%) from the impact of Hurricane Ike than highly diverse agroecologically managed farms (50% losses). Agroecological farms were also able to recover faster after the hurricane.[244]

6 Overcoming the barriers

There is now extremely good evidence that small-scale sustainable farming, which is controlled by and for communities, can deliver as much, if not more, food than large-scale high-input agriculture. There is also plenty of evidence that the livelihoods of farmers and communities can be improved, and that agroecology can deliver a huge range of other benefits, including reducing the gender gap, offering employment opportunities, improving people's health, increasing biodiversity, and increasing the resilience of food systems to cope with the impacts of climate change. So the question is no longer 'can sustainable small-scale farming feed us?'; rather, why are governments, development agencies, policy makers and funders so intransigently focused on large-scale, high-input solutions which marginalise poor and small-scale farmers, have a negative impact on our environment, and do not increase the resilience of our food system as a whole?

6.1 Change the political bias

It is clear that there is significant economic and political bias in favour of large-scale industrial agriculture. Our economic system privileges industrial farming, large-scale land owners and monopolistic corporations leading to political support for these vested interests. A change in the ideological support for industrial agriculture towards agroecology and sustainable small-scale agriculture will require the political establishment and development agencies to formulate policies based on scientific evidence and the long-term viability of our global food system.

As the eminent agroecologist Professor Miguel Altieri has put it:

> ***"The issue seems to be political or ideological rather than evidence or science based. No matter what data is presented, governments and donors influenced by big interests marginalize agroecological approaches focusing on quick-fix, external input intensive 'solutions' and proprietary technologies such as transgenic crops and chemical fertilisers. It is time for the international community to recognize that there is no other more viable path to food production in the twenty-first century than agroecology. Developing a resilient agriculture will require technologies and practices that build on agro-ecological knowledge and enable smallholder farmers to counter environmental degradation and climate change in ways that maintain sustainable agricultural livelihoods. The need to scale up the agroecological approach is long overdue and in fact is the most robust food provisioning pathway for humanity to take under current and predicted and difficult climate, energy, financial and social scenarios."***[245]

6.2 Change trade rules and policies

> ***"The time has come for African agriculture. Southeast Asia has become crowded, competitive, and expensive for doing agribusiness, chipping away at profit margins. We see higher profit potential in Africa for exports—and for domestic sales."***[246]
>
> **A foreign investor quoted in the World Bank's report 'Growing Africa'**

Current trade rules are one of the most powerful forms of governance in the world, forcing governments to sacrifice democratic decisions and priorities such as the 'right to food' in the name of free trade. For instance, India has been battling for many months at the World Trade Organisation (WTO) for its right to protect a programme giving subsidised food to the very poorest. What's more, many Southern countries have had their agricultural sector's decimated as they have been forced to remove agricultural protections like quotas and tariffs, food stockpiles and price controls, and subsidised seeds and other inputs. These are all seen as barriers to trade. This problem is compounded by the fact that many Western countries are still allowed to subsidise agriculture, meaning small African farmers being forced to compete with highly subsidised North American and European agribusiness.

In essence, then, our form of free trade is actually about protecting and promoting the privileges of foreign investors rather than promoting trade *per se*. That's why world trade policies favour industrial agriculture and are hugely biased by the power and influence of corporations. The argument runs that once investors feel safe, they will trade more with any given country, though there is little evidence to prove this. Today, governments such as the UK are even promoting the use of investor courts known as Investor State Dispute Settlement mechanisms (ISDS) in trade and investment agreements. This gives foreign corporations the ability to sue countries, outside of their domestic judicial system, for bringing in regulations which damage their profit lines. Governments introducing better protection and support for small farmers could well find themselves on the end of a costly legal case brought by an agribusiness company.

Finally, trade policies are used to implement and enforce harsh intellectual property laws, which prevent the transfer of new technologies and products from the richest to poorest parts of the world. In agriculture, this has a particular impact on seeds, where agribusiness has an interest in maximising patents on seeds, because this represents a long-term rent on the products they sell.

In Africa, much trade liberalisation has been imposed by Western controlled institutions like the International Monetary Fund (IMF) and World Bank, which have provided financial assistance to African states on the condition that they implemented Structural Adjustment Programmes (SAPs). SAPs consist of policies aimed at economic liberalisation, privatisation of public services and companies, de-regulation, and the removal of trade barriers. By the mid 1980s, almost all countries in sub-Saharan Africa had implemented SAPs.

The impact of SAPs has been extremely negative. Poverty and unemployment increased while the annual growth rate across the continent actually declined from 4.7% in 1961–1970 to 2.7% in 1980–2000.[247] The impact of SAPs on agriculture was particularly severe. Part of the purpose of SAPs was for countries to earn foreign currency in order to repay often illegitimate debts. This meant countries gearing their agricultural sector towards food export markets. So in the 1960s, before SAPs were implemented, Africa was self-sufficient in food. Between 1966 and 1970, net exports averaged 1.3 million tonnes per year. By the late 1970s, it had switched to importing 4.4 million tonnes per year, which increased to 10 million tonnes by the mid 1980s.[248] Per capita food production in Africa has stagnated or fallen over the last 40 years while increasing in east and south-east Asia. Despite all the evidence, similar programmes and policies are still imposed by the IMF and World Bank today.

In 2012, the World Bank lent US$35 billion to developing countries, equivalent to over a quarter of total global official development assistance (an indicator of international aid) that year.[249] This aid comes with strings attached. While claiming to support small-scale farmers, the World Bank aims to integrate them into the global market by promoting export-oriented, high-input agriculture and contract-farming, while simultaneously investing in large-scale agricultural projects and directly supporting land grabs (eg. through International Finance Corporation loans) some of which have resulted in serious human rights violations.[250] With its yearly Doing Business reports, the World Bank ranks countries based on an 'ease of doing business index' and pressures governments to remove regulations in favour of neoliberal reforms to obtain higher rankings. For example, until 2011, countries were scored down on the 'employing workers' indicator for having minimum wages and paid holidays. The 'registering property' indicator encourages countries to remove regulations on buying land, which has triggered an increase in corporate land grabbing.[251] Along similar lines, the World Bank recently published a report on 'Enabling the Business of Agriculture' with the aim of "understanding the enabling environment in which agribusinesses operate" and "reducing and where possible eliminating the binding constraints that are limiting growth of this vital sector".[252]

Outside the WTO, IMF and World Bank, the European Union is negotiating free trade deals with African countries, known as Economic Partnership Agreements (EPAs), which will encourage liberalisation, privatisation and investor privileges. On top of these agreements, the UK government is negotiating a number of Bilateral Investment Treaties (BITs) which will give UK companies dangerous new powers over Southern countries through Investor-State Dispute Settlements (ISDS) mechanisms. A BIT between the UK and Ethiopia is due to be ratified in 2015– 16, which, it is feared, will give agribusiness new powers in relation to Ethiopia's land and food systems, and make implementing wider agroecology much more difficult.

There's no reason why trade has to work in this way. Trade could easily prioritise and promote the ability of small farmers to sell goods, just as certain fair trade schemes currently do. What's more, trade should primarily encourage local, national and regional trading relationships, ensuring countries feed themselves before throwing them into competitive relationships with established companies in the West where customers are able to spend more on food than in domestic markets.

6.3 Increase investment

Investment in agricultural research across Africa (excluding Nigeria and South Africa) has fallen by an average of 0.3% every year since the 1990s.[253] Although African countries officially agreed to increase agricultural GDP to 6% per year under the Comprehensive Africa Agricultural Development Programme (CAADP), a programme to boost agricultural productivity in Africa, most countries still commit less than 3%.[254] Of course, the size of the budgets of African countries as well as the pressure they face with debt repayments means that there is little scope for large increases in investment in agricultural research. It also means that many African countries rely heavily on funding from richer developed countries and development agencies and donors. A study by IFPRI in 2007 estimated that if agricultural spending in Kenya was 10% of total government spending, an additional 1.5 million people would be lifted out of poverty by 2015.[255]

The issue of investment is also tied up with the issue of aid. Western governments contribute a total of around US$30 billion in development aid every year to Africa, yet more than six times that amount leaves the continent – through debt repayments (US$21 billion a year), tax evasion, and climate change mitigation.[256] Philanthropic organisations, like the Bill & Melinda Gates Foundation, have been criticised for spending most of their agriculture grant money in the US, Britain and other rich countries, with just 4% spent on Africa-based groups, and almost a third of its US$3 billion budget spent on CGIAR centres (who in the 1960s and '70s were responsible for developing and promoting the chemical fertiliser and pesticide-based 'green revolution') and the Alliance for a Green Revolution in Africa, which is pushing the same agenda across Africa today. Not only is aid in many cases being used to help multinational corporations extract resources from Africa, but providing aid is helping governments and donor organisations hide the reality of this looting behind a smokescreen:

> ***"UK and other wealthy governments celebrate their generosity whilst simultaneously assisting their companies to drain Africa's resources; companies promote their 'corporate responsibility' whilst routing profits through tax havens; wealthy philanthropists donate money whilst their companies dodge tax; and short-term fundraising tactics mean NGOs ourselves can be guilty of pushing the idea that poverty can be solved if we give a few pounds, whilst ignoring the systematic theft going on under our noses."***[257]

Policy reforms supported by aid programmes like the New Alliance make it easier for corporations to 'do business' in African countries. Over 200 policy reforms in Africa backed by the New Alliance aim to help corporations access land, seeds, water and labour, extract resources for export markets, and increase the profits of shareholders based in rich countries.

Lack of investment is not the only issue: how investments are used is even more important. The CAADP emphasises high-tech conventional farming which relies on expensive inputs, such as chemical pesticides and fertilisers, and proprietary high-yielding seeds. Although CAADP's framework document mentions "upscaling sustainable land and water management", it also talks about "building the potential for a new Green Revolution approach".[258] Additionally, a review of CAADP investment plans in six African countries found that the plans paid little attention to the needs of women farmers, despite evidence in an FAO study

which found that if women had access to the same number of farm inputs as men they would be able to increase yields by up to 30% (through better management of resources like organic fertiliser and credit),[259] and although the study does not clarify what kind of inputs (chemical fertilisers), the same logic would, no doubt, apply to organic inputs also.

According to a statement signed by nine African civil society organisations, "CAADP itself is a compromised instrument, calling for the very policies and programmes favoured by the multinationals".[260] A report published by the South African organisation Trust for Community Outreach and Education (TCOE) suggests that the CAADP "focuses on financial and technical issues but neglects addressing socio-economic issues and meeting the needs of rural people, in particular the needs of women".[261] It expresses concern that CAADP may pose a threat to small-scale farmers' autonomy by: making them increasingly dependent on expensive inputs; reducing the availability of seed varieties and the ability of farmers to save, exchange and sell seeds; reducing farmers access to land and water; and increasing farmer indebtedness.[262]

Small-scale farmers in low and middle-income countries invest more than US$170 billion every year on their farms, making them the single biggest investors in agriculture.[263] Despite their enormous contribution, many farmers have difficulty getting access to affordable credit. It is crucial that investors in African agriculture, as well as investor and financing policy, supports small-scale farmers and recognises them as effective investors – farmers need access to fair and affordable credit.

In countries like Tanzania and Ethiopia, financial credit is mainly available in the larger urban centres but unaffordable to most, given the high collateral requirements, while in Uganda, for example, high interest rates make it harder to invest in the agricultural sector.[264] Micro-finance has become more widely available but has still, generally, failed to reach poorer and more rural areas where the majority of small-scale farmers live,[265] and the evidence increasingly shows that it can have a negative impact on clients over time.[266]

The United Nations has estimated that spending an additional 0.16% of global GDP on sustainable agriculture each year from 2011 to 2050 on 'greening agriculture' would have considerable benefits, compared to a business-as-usual (BAU) scenario including:[267]

- Increasing total agricultural production (agriculture, livestock, fishery and forestry) and overall calorie availability per person from 2,800 Kcal per person per day to around 3,200 Kcal by 2050;
- Creating an estimated 47 million additional jobs compared to BAU;
- Reducing deforestation and freshwater use by 55% and 35% respectively;
- Reducing global greenhouse gas emissions by 2% compared to BAU despite the increase in overall food production.

Investment in agriculture is not just about increasing food production or increasing capital for farmers and investors. It is about supporting activities that lead to the accumulation of physical, human, intellectual, natural, social or financial capital over time. Investments by large corporations, and initiatives like the New Alliance, do not guarantee these sorts of benefits as they focus mainly on the economic returns related to financial investments.

Investment should not be tied to policy reforms which promote corporate controlled economic growth at the expense of small-scale and poor farmers. Also, the UK and other governments should not be pushing for trade liberalisation, whether through aid conditionality (tied aid), trade agreements or any other means which prevents developing countries from protecting their own agricultural production. Instead, trade rules and policies should be modified to support food sovereignty and agroecology, and to increase farmers' control over their livelihoods and resources, rather than reducing them. Policies should be designed to uphold the autonomy and sovereignty of governments receiving aid, so that they are able to regulate their economy and support agroecology.

6.4 Increase research

"It is time to invest in analytically rigorous, agroecological and socio-economic research oriented at eliminating yield gaps between sustainable and conventional agriculture (when they occur), identifying barriers to adoption of sustainable techniques and improving livelihoods of the rural poor."[268]

Although there is increasing evidence of the benefits of agroecology, there is still a need for more research, which is compounded by a serious lack of funding for it compared to research on conventional agriculture. In the UK, for example, the government spent £49 million on agricultural biotechnology between 2006 and 2007 (not including individual grants made available from the biotechnology and biological sciences research council) compared to £1.6 million on organic farming during the same period.[269] In the United States, only around 1.5% of the USDA's research and extension expenditure is spent on organic agriculture: 98.5% goes to conventional agriculture.[270] There is a clear need to realign funding and research agendas towards sustainable farming and agroecology – particularly given the increasingly strong evidence of the benefits of these low-input practices on a wide range of environmental, social and economic indicators.

6.5 Focus on small-scale solutions

Another barrier to the wider adoption of agroecology is the blinkered focus on large-scale farming: on mega-projects, agricultural growth corridors and high-tech mechanisation.[271] This high-input approach has been able to increase food yields for many years (at the expense of people and the environment), but global crop yields have been flat-lining in many parts of the world, and in some countries yields have actually been declining.[272] This is why the future wave of innovation will need to come from farmers themselves and farmer-based research and development:[273]

> ***"What one farmer can do to boost yield or efficiency is not necessarily the same as for a farmer hundreds of kilometres away with different soils, microclimate, topology and methods ... Farmers everywhere are practical experimentalists who understand the idiosyncrasies of their land. Modern agronomy evolved out of practices such as rotating crops to rebuild soil nutrients, fertilizing fields with manure, and adding lime to soil to alter pH. Even technologies not invented by farmers – new kit, seeds or chemicals – are adapted by them to fit their circumstances ... Field labs could boost farmers' productivity by supporting low-cost innovations that fly below the radars of large research institutions. When farmers produce knowledge, they are more likely to adopt new practices, and their insights are more likely to be relevant to local conditions."***
>
> **Dr. Tom MacMillan (Director of Innovation, Soil Association, UK) and Professor Tim G. Benton (Global Food Security programme, University of Leeds, UK)[274]**

The field labs mentioned in the quote above are similar to the farmer field schools which have been a popular model for sharing knowledge and training farmers in agroecological skills. Building on a farmer-to-farmer approach, a number of agroecological schools have been developed in Mozambique, Mali, Niger and, most recently, in Zimbabwe. The Zimbabwe Organic Smallholder Farmers Forum (ZIMSOFF) developed the Shashe Agro-Ecology School, with the support of the Participatory Ecological Land Use Management network, to develop a farmer-to-farmer learning system which focused on young people and women and trained them in agroecological and sustainable agriculture techniques.[275] These people then act as community facilitators and go on and train other farmers. The Shashe Agro-Ecology School shows how farmers themselves can play a key role in training other farmers, and share their knowledge, skills and innovations more effectively.

When it comes to helping farmers to learn and develop new practices to improve their yields and income, smaller-scale programmes such as farmer field schools, farmer to farmer knowledge exchange, and farmer-led innovation are extremely effective.

6.6 Reform land ownership and improve land tenure arrangements

An estimated 90% of rural land in Africa is unregistered making it particularly susceptible to land grabs and unfair expropriation by governments on behalf of multinational corporations.[276] The lack of secure land tenure also means that small-scale farmers are less likely to invest time and money on their land. In Ethiopia, small-scale farmers with no land tenure have

little incentive to build terraces on steep agricultural land which would help them to improve future food productivity.[277] In this situation, government action to improve land tenure rights or redistribute land could have a significant positive impact on rural investment and food production yields. In some cases this might mean land reform with land redistribution to increase land-use productivity and provide landless farmers – and farmers with insecure tenancy – greater access to land.

But behind the problem of insecure land tenure is a deeper rooted problem of land ownership inequality, which goes back to the colonial era and before and looms large to this day. Across the continent, households in the highest income per capita quartile control up to fifteen times more land than people in the lowest quartile.[278]

In apartheid-era South Africa, almost 90% of the land was owned by less than 10% of the population (the white ruling class). In 1994, with Nelson Mandela in power, land restitution was high on the agenda and the African National Congress committed to redistributing 30% of white-owned land to the black majority population in the first five years. By 2010 less than 7% had been redistributed and much of it lay unused.[279] Part of the problem has been the government's focus on large-scale commercial production and its strategy of settling poor farmers that are more familiar with small-scale farm production methods.[280]

This focus on large-scale commercial farming has meant that in countries across Africa, the most suitable land for cultivation is snapped up by agribusiness or large-scale land owners rather than small-scale farmers working primarily to meet their own food needs and those of the local population.

Land tenure is a complex issue and improving tenure rights and the growth of private property rights can, in some cases, facilitate corporate land grabbing and strengthen private land ownership by already rich investors and farmers. Corporations and other powerful actors can increase their control of land either directly, with medium and long-term leases, or through direct land purchases, but they can also control land and labour through contract farming arrangements. Improving land tenure arrangements should go hand in hand with land reform and land redistribution which prioritises the needs of small-scale farmers and farming communities and reduces land ownership inequality:

> ***"Land should be redistributed to small farmers as an inalienable good, not as a commercial asset that can be lost if rural families are not able to cope with the highly discriminatory situations that they face. Farming communities should also be able to decide by and for themselves, and without pressure, the type of land tenure they want to practice."***
>
> **GRAIN, Hungry for Land report, 2014[281]**

Although securing land tenure is important, it is not always a top priority for farmers. A study among farmers in north-east Ghana showed that poor agricultural production and land degradation were perceived to be due mainly to issues like soil fertility, irregular rainfall, plant diseases and lack of financial support rather than land tenure arrangements. The study concluded that: "tenure security is a necessary but not a sufficient condition for improvement in agricultural production and environmental management in north-east Ghana".[283]

Women's land rights in Maradi, Niger

Through the work of the Women and Land Initiative, women's groups have been able to increase their access to land either by buying it, leasing it, or securing land tenure on inherited land through Niger's Land Act. Women active in local land committees have helped other women to secure their own access to land by offering advice and using community dialogue techniques. Improving land tenure has enabled these women to increase their household food security.[282]

7 Policy proposals

The positive solutions outlined in this report have developed despite an unsupportive policy context. These examples demonstrate that agroecology can produce just as much food – and with additional benefits to biodiversity, women's rights, employment and income, health and nutrition, and climate change – as the large-scale corporate model of agriculture supported by governments like the UK and financial initiatives like the New Alliance.

The UK first needs to stop making the system worse, by assisting farmers to use agroecology to help feed their communities and build resilient livelihoods. With the right policy commitments, the UK and other donors can help transform Africa's food system for the better on communities' terms.

It is within a positive policy framework that agroecology, as a tool for food sovereignty, can best be supported. It is therefore essential that the UK and other donors do not pressure states receiving aid to commit to land, trade, seed and other agricultural policy reforms that risk the livelihoods and resilience of small-scale farmers and the food sovereignty of communities.

In this context, to help overcome the barriers faced by agroecology and sustainable small-scale agriculture, the governments of the UK and other aid donors should:

1. **Support food sovereignty. This requires the UK government to:**
   a. Recognise and support policies and actions within the food sovereignty framework;
   b. Ensure that other UK government policies support rather than undermine food sovereignty, such as those that promote the corporate control of agricultural and other sectors.

2. **Increase investment into agroecology by:**
   a. Aligning UK aid spending on food and agricultural-related projects with the principles of agroecology defined within the framework of food sovereignty. Global Justice Now recommends that this should encompass:
      i. Research, training and support through agricultural extension for small-scale agroecological production (eg. agroecology schools);
      ii. Supporting the provision of infrastructure and technology suitable for the needs of small-scale, sustainable farming;
      iii. Improving small-scale producers' access to local, national and regional markets, including through support for transport and market infrastructure suited especially to the needs of this group, access to market information, and improvement of small-scale producer bargaining power (eg. through co-operatives);
      iv. Improving small-scale producers access to finance, especially for women, by:
         - Improving access to sustainable credit at fair rates;
         - Improving access to sustainable finance systems that facilitate saving and investment in the local and rural setting;
         - Supporting public investment that is controlled by and serves small-scale producer communities, as well as community-controlled investments through enterprises including cooperatives.
      v. Supporting countries in the global south in the development and implementation of policies to protect and support small-scale producers;
      vi. Supporting public sector investment in developing the seed sector by prioritising support for community and farmer-managed seed systems based on co-operation and common ownership using appropriate and sustainable technologies free from corporate control.

3. **Increase research and evidence base by:**
   a. Realigning funding and research agendas towards sustainable farming and agroecology;
   b. Supporting African governments, NGOs and community groups to develop monitoring and evaluation of agroecological projects to increase evidence base.

4. **Focus on small-scale solutions by:**
   a. Promoting the development of community seed banks, farmer field schools, agroecology schools, demonstration farms and farmer-to-farmer exchanges;
   b. Supporting community-based seed initiatives, such as community seed banks and participatory plant breeding, which help farmers to improve access to affordable and productive seed varieties.

5. **Help small-scale farmers increase access to, and control of, land and resources by:**
   a. Supporting land tenure arrangements that increase access to, and control of, land by small-scale farming communities, in particular through co-operative and communal land ownership systems;
   b. Supporting land reform and land redistribution initiatives in their favour;
   c. Supporting and protecting pastoralists and other farmers' access to common land.

6. **End support for the corporate control of African food systems by:**
   a. Stopping UK aid money being used to fund food and agricultural projects which favour big business and put the livelihoods and resilience of small-scale farmers at risk;
   b. Ending all aid conditionality;
   c. Ending UK government support for the World Bank's Doing Business index;
   d. Ending UK government support for plant variety protection laws aligned to international accords such as UPOV and TRIPS that increase corporate control of seeds and limit farmers' ability to improve, save, share and sell seeds locally;
   e. Ensuring that trade agreements and UK-backed policies do not prevent governments from protecting their agriculture sectors from subsidised imports and from investing in sustainable agriculture projects; this includes supporting governments to implement insurance systems such as stockpiling and price controls;
   f. Removing ISDS mechanisms from all future Bilateral Investment and Free Trade agreements, and conducting a review of all pending investment and trade agreements to examine their impact on small farmers and food sovereignty;
   g. Promoting technology transfer through trade;
   h. Supporting the development of public services;
   i. Supporting the development of domestic and regional trade and infrastructure.

7. **Support women farmers by:**
   a. Explicitly targeting women farmers and women farmer groups through agricultural projects, agricultural extension, research and rural credit programmes and ensuring that these projects are specifically designed to benefit women;
   b. Support women farmers' access to resources including land, seeds and finance.

This report has shown how agroecology can feed Africa by increasing food yields. But a food system is about much more than just food production. For a food system to work in the long-term and benefit all the people involved in the food chain – from the farmers to the consumers – as well as the environment, it needs to be democratically controlled and based on sustainable and equitable principles. This is what agroecology is all about and the evidence in favour of it is now overwhelming. Not only can agroecology increase yields, but it has multiple positive knock-on effects by reducing the gender gap, increasing employment and income, improving health and nutrition, increasing biodiversity, and addressing the causes and consequences of climate change.

The current rules that govern our global food system are rigged in favour of corporate controlled agriculture. What we really need is for governments, donors and international institutions to radically shift from the current corporate-led approach to farming and instead support sustainable small-scale farming and agroecology. By supporting agroecology, governments can help to increase farmers' democratic control of land, seeds, water and other resources, thus creating a more sustainable, equitable and viable food system.

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Global Justice Now campaigns for a world where resources are controlled by the many, not the few. We work in solidarity with social movements to fight injustice and inequality. We used to be the World Development Movement.

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