Fostering Economic Resilience

The Financial Benefits of Ecological Farming in Kenya and Malawi

GREENPEACE

© Greenpeace / Lasse Van Aken. Children in Malawi share a light moment with Greenpeace researchers, Malawi. 2014.

For more information contact: iafrica@greenpeace.org

Written by: Mark Curtis

Researchers: Lasse van Aken, Glen Tyler, Frank Chidawanyika, Susan Nakacwa, Reyes Tirado, Iza Kruszewska, Monique Mikhail

With help from: *icipe* – African Insect Science for Food and Health, Total Land Care: Trent Bunderson, Zwide Jere, Richard Museka, Brown Kapoloma, Mike Mkandawire

Designed by: Kaitoma Creatives

Cover photo: © Greenpeace / Sven Torfinn. Small-scale farmer James Njoronge inspecting his crops. 2013.

Published: February 2015 by Greenpeace Africa

Greenpeace Africa: 10A and 10B Clamart House, Clamart Road, Richmond, Johannesburg, 2092, South Africa, www.greenpeaceafrica.org

Printed on 100% recycled post-consumer paper with vegetable based inks.

Contents

GREENPEACE

Glossary

Agroecology

Agroecology refers to the scientific discipline of studying agriculture as ecosystems, looking at all interactions and functions (i.e. producing food but also cycling nutrients, building resilience, etc.).

Agroforestry

Greenpeace follows the definition of Agroforestry included in the IAASTD reports: "A dynamic, ecologically based, natural resources management system that through the integration of trees in farms and in the landscape diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. Agroforestry focuses on the wide range of work with trees grown on farms and in rural landscapes. Among these are fertiliser trees for land regeneration, soil health and food security; fruit trees for nutrition; fodder trees that improve smallholder livestock production; timber and fuelwood trees for shelter and energy; medicinal trees to combat disease; and trees that produce gums, resins or latex products. Many of these trees are multipurpose, providing a range of social, economic and environmental benefits."[1]

Bio-fertilisers

Bio-fertilisers are substances that contain agriculturally beneficial micro-organisms which, when applied to the soil, can form mutually beneficial relationships with plants and can assist nutrient availability. Good quality bio-fertilisers need to be tailored for specific locations and crops, and made available to farmers at minimal or no cost.

Chemical-Intensive Agriculture

This agricultural model is characterised by low fallow ratios of land, mechanisation of agriculture and the extensive use of chemical fertilisers and/or pesticides. Chemical-intensive agriculture is widely associated with the so-called green revolution and the many negative effects on humans and the environment, from algae blooms (dead zones) to poisoning of farmers and farm workers.

Conservation Agriculture

Conservation Agriculture is a management system for growing crops that is based on three principles that should be applied together and reinforce each other: minimum physical soil disturbance (no tilling); permanent soil cover with live or dead plant material (mulching or growing cover crops); and crop diversification in space and time (growing complementary crops together, and crop rotation). Herbicides are sometimes promoted as being part of conservation agriculture, however, if conservation agriculture is to be truly sustainable, herbicides cannot form part of the system.

Donors

We define donors broadly to include: governments providing bilateral overseas development assistance, multilateral financial institutions, philanthropies, and international (UN) development organisations.

Ecological Farming

Ecological farming encompasses a wide range of modern crop and livestock management systems that seek to increase yields and incomes and maximise the sustainable use of local natural resources whilst minimising the need for external inputs. Ecological farming ensures healthy farming and healthy food for today and tomorrow, by protecting soil, water and climate. It promotes biodiversity, and does not contaminate the environment with chemical inputs or genetically engineered plant varieties.

Organic Farming

Organic farming is a system of crop production that avoids the use of chemical fertilisers or chemical pest and disease control measures. The International Federation of Organic Agricultural Producers (IFOAM) defines organic agriculture as: "…a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."[2]

Push-Pull Technology

Push-Pull Technology is a form of ecological farming used to control parasitic weeds and pest insects that damage crops. It involves no use of chemical pesticides. Volatile chemicals from Desmodium, a leguminous herb, intercropped with the food crop (maize, sorghum or rice) repel corn borer moths (push), while volatile chemicals from a border of Napier Grass attract the moths, which lay eggs in the grass instead of the crop (pull). Desmodium also improves soil fertility, thereby combating the parasitic Striga weed. Push-pull is an affordable farming technique for small-scale farmers which not only increases yield, it also provides a source of fodder for animals (Napier Grass) which increases milk yields.

Summary

Faced with widespread hunger and the need to increase farm production to feed a growing population, many governments in Africa and elsewhere are spending vast amounts of money on getting chemical fertilisers and pesticides to farmers. Furthermore donors like the US and Britain, as well as private philanthropies like the Gates Foundation, are also pushing for increased use of chemicals as the solution to raising farm productivity in Africa.

Yet this strategy is grossly misplaced. The evidence in this report suggests that it is more profitable for small-scale farmers in Africa to practise ecological farming that uses no chemical pesticides or fertilisers than it is to use chemicals. Presenting the results of new fieldwork in Malawi and Kenya, this report shows that farmers practising agroforestry (involving the use of natural 'fertiliser trees' instead of chemical fertilisers) and 'Push-Pull' technology (which eliminates the need for chemical pesticides) achieve higher incomes and yields than those practising chemical-intensive agriculture.

Greenpeace is campaigning for ecological farming in East Africa. Governments and donors must re-focus their agriculture spending to support ecological farming since it is economically more beneficial for small-scale farmers. The time is ripe to do this given that 2014 has been designated the African Union Year of Agriculture and the International Year of Family Farming.

Comparing chemical-intensive and ecological farming

Chemical-intensive agriculture involves a substantial use of chemical fertilisers and pesticides, together with hybrid seeds. It is often associated with the production of cash crops for export and consolidates large areas of land under monocultures (the production of a single crop). Nitrogen fertiliser use has grown by over 900 per cent since the 1960s and projections are for a further rise of 40-50 per cent in the next 40 years.[3] The major beneficiaries of the model will continue to be the multinational corporations manufacturing the chemicals and seeds, not the small-scale farmers being encouraged to buy them.

Chemical-intensive farming is fraught with problems. It can be a massive cost for farmers and governments: Ten countries in sub-Saharan Africa are currently spending US$1.05 billion a year on fertiliser subsidy programmes, an average of 30 per cent of their agriculture budgets.[4] Chemical-intensive farming also causes farmer and public health problems due to pesticide use: The UN Environment Programme has calculated that the cost of pesticide-related illnesses in sub-Saharan Africa, for governments and those affected, could reach $90 billion during 2005-20.[5]

The use of chemicals often damages soils, by acidification for example (now a widespread problem in many parts of Asia, after years of chemical fertiliser dependence).[6] Overuse and inefficient use of chemical fertilisers is a major global problem: some 30-80 per cent of nitrogen applied to farmland as fertiliser escapes to contaminate water systems and the environment.[7] Chemical-intensive farming is also a major contributor to climate change: agriculture accounts for as much as 32 per cent of global greenhouse gas emissions (including the impact of deforestation caused by farming)[8] and the manufacturing, transport, distribution and use of chemical fertilisers alone accounts for around 5 per cent of emissions[9].

By contrast, ecological (often called 'agroecological') farming ensures healthy farming and food by protecting soil, water and climate, promotes biodiversity and does not contaminate the environment with chemical inputs. Ecological farming is both a climate mitigation and adaptation strategy: mitigating climate change by eliminating dependence on fossil fuels, and also enhancing the resilience of poor communities in the face of climate shocks. Ecological farming also makes the best possible use of locally available inputs, thus keeping money in the local economy. Such farming practices include agroforestry, Push-Pull technology, sustainable land management, water harvesting and organic farming. There is substantial evidence that farmers who start using ecological farming methods can increase yields significantly, particularly in Africa.[10]

Critically, and a key focus of this report, ecological farming entails lower production costs and thus often increases incomes for small-scale farmers in resource-poor communities.

Fieldwork findings in Kenya and Malawi

Kenya

Push-Pull Technology is a form of ecological farming used to control parasitic weeds and insects that damage crops, and which involves no use of chemical pesticides. Our fieldwork among four groups of small-scale farmers in Kitale and Mbita regions of western Kenya measured the benefits of practising Push-Pull compared to the absence of Push-Pull and to using chemical pesticides.

We found that:

- The average profitability per acre of maize per year (meaning the value of production minus costs) in Kitale was $588 for Push-Pull farmers but only $193 for chemical farmers – three times greater and a difference of $395 per acre per year.

- In Mbita, average profitability was $433 for Push-Pull farmers and $142 for non- Push-Pull farmers – also three times greater and a difference of $291 per acre per year.
- If the same results were applied across Kenya, farmers' incomes could more than double and the gains for Kenya's four million farmers would total $2.7 billion, a huge injection of revenues into poor rural areas.
- This increased income for farmers is due to a combination of better yields and lower production costs. Average yields for maize grown using Push-Pull are roughly double those of farmers not practising Push-Pull. While Push-Pull farmers in Kitale spend nothing on pesticides and a small amount on fertilisers ($44), chemical farmers spend an average of $159 per year on pesticides and fertiliser.

Malawi

Greenpeace interviewed maize farmers in Salima district of central Malawi to assess the relative benefits of farmers using chemicals or agroforestry. Agroforestry is a form of ecological farming that incorporates 'fertiliser trees' into farming systems to build soil health without the use of chemical fertiliser.

We found that:

- The average profitability per acre of maize (value of production minus costs) was $259 for agroforestry farmers and $166 for chemical farmers – a difference of $93 per acre per year.* This is a significant sum in rural Malawi, amounting to around one third of average annual incomes (which are around $270[11]).
- Crucially, agroforestry farmers secure much higher incomes than those farmers buying fertiliser *even at subsidised prices under the government's fertiliser subsidy programme*.
- As in Kenya, farm costs are much lower for agroforestry farmers than for those using chemicals – 9 per cent of the value of production compared to 32 per cent (due mainly to purchases of expensive chemical fertilisers).
- If the 1.5 million Malawian farmers currently using chemical fertilisers were able to switch to agroforestry, they could earn a combined $209 million extra income per year.[12]
- Maize yields of agroforestry farmers were higher: 1,137 kg per acre compared to only 828 kg per acre for chemical farmers.

It is often believed that ecological farming requires more labour time and costs than chemical-intensive farming. Our research challenges this. In Kitale, a smaller number of Push-Pull farmers incur labour costs than chemical farmers (61 per cent compared to 80 per cent). In Malawi, more farmers buying chemicals (29 per cent of farmers) incurred labour costs on their farm (for all crops including maize) than those practising agroforestry (21 per cent).

Not only do our findings suggest that agroforestry and Push-Pull are more profitable for farmers than using chemical fertilisers and pesticides, but also that many chemical farmers would switch to ecological farming if the government supported the transition. Such support is likely to be more cost-effective for the government, and more profitable for farmers, than subsidising or using chemical fertilisers.

Government spending on chemicals and ecological farming

Currently, most governments around the world are spending far more on chemicals than ecological farming. Although some governments are promoting forms of ecological farming, only one country – India – has so far adopted a cohesive national policy on agroforestry, for example, and this was approved only in February 2014.[13]

The Kenyan government spent $34.3 million in 2012/13 on its input (fertilisers and seeds) subsidy programme – the National Accelerated Agricultural Inputs Access Programme (NAAIAP).[14] Kenya imported $1.3 billion worth of chemical fertilisers and $578 million worth of pesticides during 2004-11. In addition, the government is planning to build a fertiliser manufacturing plant at a massive cost of $442 million.[15] Government figures are not disaggregated to show how much is spent on ecological farming, but it is likely to be significantly lower than the level currently or planned to be spent promoting chemical inputs.

Similarly, Malawi has become well-known for its large-scale Farm Input Subsidy Programme (FISP), which offers fertilisers at subsidised prices and which has increased the yields of many farmers who previously suffered deep food insecurity crises. However, the FISP accounted for a huge 51 per cent of the country's agriculture budget in 2012/13 and 43 per cent in 2013/14.[16] This amounts to around 9 per cent of Malawi's entire national budget in both years. As in Kenya, our findings suggest that it would be more profitable for farmers and the government to invest this money in ecological farming. Yet Malawi's budget allocation to the FISP is ten times greater than spending on ecological farming.

Recommendations

Our findings show that, to enhance small-scale farmers' economic well-being and food security, governments will get better value for their money by supporting ecological farming over chemical inputs. Therefore, governments should reduce their support to chemical-intensive agriculture by phasing out chemical input subsidy programmes, and promote 'enabling' policies that support ecological farming. This can be accomplished by:

* This is not the same as income. The value of production is the worth of maize produced if sold (which it often is not).

- Establishing time-bound targets to reduce and then eliminate the use of chemical inputs.
- Drastically increasing national budgets devoted to supporting ecological farming.
- Creating and fully funding Ecological Farming Strategies that include plans for phasing out fertiliser subsidies and the use of other chemicals such as pesticides.
- Establishing strategies to increase the use of organic fertilisers, and to provide supportive and enabling policies to achieve this. This policy package should form part of the governments' climate adaptation programmes.
- Establishing subsidy programmes that support ecological farming, such as by promoting bio-fertilisers
- Refocusing extension, agricultural research and rural credit programmes to move away from supporting chemical-intensive agriculture and towards supporting ecological farming.
- Disaggregating and tracking budget spending on ecological farming to assess and increase support for this over time.

Donors should:

- Fund larger studies than we have been able to undertake for this report to assess the profitability for small-scale farmers of ecological farming approaches, and identify how these can be scaled up to reach larger numbers of farmers.
- Increase investments in and shift existing agricultural finance to scale up ecological farming. Investments must be predictable, transparent, untied, and channelled through budget support where appropriate.
- Invest in rebuilding extension services to scale up the uptake of ecological farming practices.
- Champion reform of global agricultural research and development to re-focus this on ecological farming.
- Focus climate change adaptation plans and financing on supporting those most vulnerable to risk – small-scale farmers – to increase their uptake of ecological farming practices to increase resilience

© Greenpeace / Sven Torfinn. Small-scale farmer James Njoronge inspects his maize crop in Thika. 2013.

Introduction

This report suggests that it is more profitable for small-scale farmers in Africa to practise ecological farming than it is to use chemical pesticides and fertilisers. Presenting the results of new fieldwork in Malawi and Kenya, we show that farmers practising agroforestry (involving the use of natural 'fertiliser trees' instead of chemical fertilisers) and 'Push-Pull' technology (instead of chemical pesticides) achieve higher incomes and yields than when practising chemical-intensive agriculture.

Yet governments in Africa are spending far more on getting chemical fertilisers to their farmers, often through public subsidy programmes, than they are on supporting ecological farming. And donors like the US and Britain, as well as private foundations like the Gates Foundation, are pushing for the increasing use of chemicals as the solution to raising farm productivity in Africa.

Instead, governments and donors must re-focus their agriculture spending to support farming that really works for poor farmers. The time is ripe to do this given that 2014 has been designated the African Union Year of Agriculture and the International Year of Family Farming. The African Union's new vision for Agriculture and Food Security, adopted in July 2014, 'reaffirms the continent's resolve to end poverty through inclusive agricultural growth'.[17]

Most studies of ecological farming highlight the yield benefits to farmers, with little or no emphasis on income benefits – one gap that this study seeks to rectify. The report was commissioned by Greenpeace Africa, and written by an independent external author, Mark Curtis, who not only wrote the report, but also analysed the data we gathered to ensure neutrality. It begins by highlighting the problems associated with chemical-intensive agriculture and the benefits of ecological farming. It then looks in detail at Malawi and Kenya, assessing the extent to which these states' agriculture budgets are supporting agro-ecological and chemical farming.

The report then presents the findings from our fieldwork among farmers in Malawi and Kenya, which we believe shows the need to shift the focus and spending of agriculture budgets towards ecological approaches. These two countries were chosen for our research, because groups of farmers in both countries have adopted ecological farming approaches – agroforestry in Malawi and Push-Pull technology in Kenya. We conclude with recommendations on how governments must make the shift towards subsidising ecological farming.

© Greenpeace / Sven Torfinn. A woman inspects a crop of sorghum. 2013.

1. Comparing Chemical-Intensive and Ecological Farming

1.1 Problems with industrial farming

Chemical-intensive agriculture – often called industrial, conventional or high input agriculture – involves substantial use of chemical fertilisers and pesticides, together with hybrid seed varieties. It is often associated with the production of cash crops for export and consolidates large areas of land for monocultures (the production of a single crop). In this model, farmers are usually required to borrow money to buy chemical inputs, thus increasing their costs of production, on the assumption that their crop sales will be sufficient to repay their debts. The model has caused a massive rise in the use of chemicals: since the 1960s, the use of nitrogen fertilisers globally has grown by over 900 per cent and projections are for a further rise of 40-50 per cent in the next 40 years.[18] The major beneficiaries of the model will continue to be the multinational corporations manufacturing the chemicals and seeds.

Many governments, donors and other analysts now espouse a Green Revolution for Africa, yet chemical-intensive farming is fraught with problems.

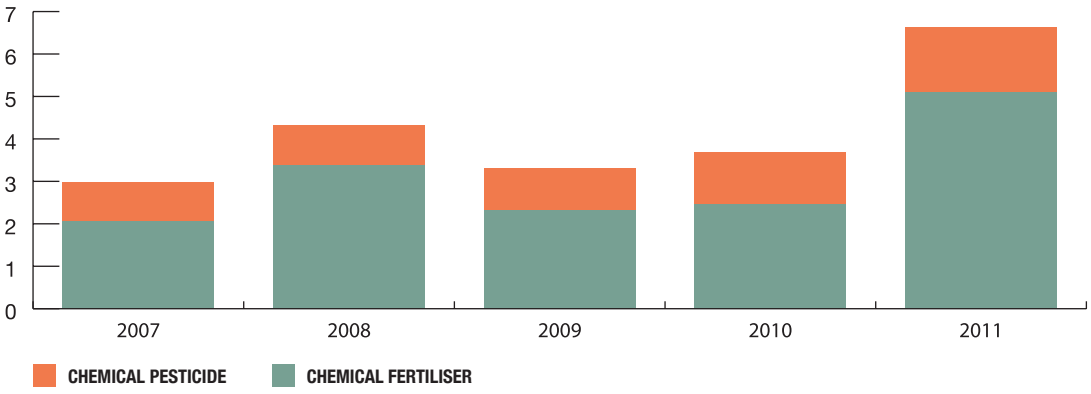
First: it can mean massive costs for farmers and governments, increasing **indebtedness**. Farmers often have to take out loans to buy expensive chemicals and seeds, on which they become dependent for their farm production. When the price of commodities falls or crops fail due to pests or disease, farmers can lose their livelihood, especially if they rely on monocultures; this is most brutally evidenced in the huge number of farmer suicides in India – around 270,000 since 1995.[19] Farmer indebtedness in Africa is lower than in Asia due to lower use of chemicals, yet there are examples of catastrophic outcomes for African farmers. In 2010, for example, up to 2,000 farmers in Kenya's Eastern Province committed suicide after crop failures meant they were left with tens of millions of dollars in farm debts.[20]

Second: the promotion of chemicals can entail **massive costs for governments**. One estimate is that 10 countries in sub-Saharan Africa are currently spending around $1.05 billion a year on fertiliser subsidy programmes, which amounts to an average of 30 per cent of their agriculture budgets.[21] The FAO lists 11 sub-Saharan African countries as having large-scale input subsidy programmes and a further six as having small-scale/ad hoc programmes.[22] The cost of importing chemicals is also huge: Sub-Saharan Africa imported $5.1 billion worth of chemical fertilisers in 2011, up from $2.47 billion in 2010, and imported $1.5 billion worth of chemical pesticides.[23]

A third problem with chemical-intensive farming, is **farmer and public health problems** due to pesticide use. There are no accurate figures, but the World Health Organisation has estimated that there are 1-5 million cases of pesticide poisoning every year causing 20,000 fatalities among agricultural workers, most of them in developing countries.[24] Governments and the public ultimately bear the costs: the UN Environment Programme says that the cost of pesticide-related illnesses in sub-Saharan Africa could reach $90 billion during 2005-20.[25] Farmers in Africa using pesticides routinely go without adequate protective clothing, mainly because they cannot afford to buy such equipment. Pesticides are often stored inside houses, close to food and within reach of children.

Fourth: soils and the environment are polluted by the use of chemicals. Some 30-80 per cent of nitrogen applied to farmland as fertilisers escape to contaminate water systems and the atmosphere.[26] A study in two chemical-intensive locations in northern China found that nearly

Table 1: Imports by Sub-Saharan Africa ($ billion)



Source: FAOStat, http://faostat3.fao.org/faostat-gateway/go/to/home/E

half the amount of nitrogen fertilisers applied by farmers leach into the environment.[27] In developing countries, vast areas of cropland, grassland and forest have been lost or degraded due to over-intensive cultivation and excessive use of chemical fertilisers.[28]

Fifth: chemical-intensive farming is also a major **contributor to climate change**. Nitrous oxide (N2O) is released mainly by using nitrogen fertilisers in soils while carbon dioxide (CO2) is emitted in the production of fertilisers (among other ways). The manufacturing, transport, distribution and use of fertilisers alone may account for around 5 per cent of global greenhouse gas emissions.[29] The FAO states that a widespread conversion to organic farming could mitigate 40-65 per cent of the world's greenhouse gas emissions from agriculture.[30]

Sixth: farming monocultures to increase yields has often **made farmers dependent on one or two crops**, putting them at financial risk if market prices for those crops fall or weather or pest problems damage those crops. Together with high fertiliser use, monocultures have often increased pest and disease problems, since they create a dense, uniform canopy in which pests can thrive as well as reduced biodiversity. To combat this, farmers often resort to overusing chemical pesticides which in turn kills natural predators; in turn, pests re-emerge and develop resistance, prompting the application of still more chemical pesticides.

Ecological farming (often called agroecological agriculture) ensures healthy farming and healthy food by protecting soil, water and climate, promotes biodiversity and does not contaminate the environment with chemical inputs or genetic engineering.[31] Ecological farming practices can provide enough nutrients in a fertile soil to grow food for all, without the need for chemical fertilisers. The use of organic fertilisers, where cheap and locally available, makes ecological farming more secure and less vulnerable to accessing external chemical inputs and price fluctuations. Ecological farming makes the best possible use of locally available inputs, thus keeping money in the local economy, building up natural soil fertility, and growing more food with fewer external inputs.

Ecological farming includes practices such as soil conservation, sustainable land management, water harvesting, organic farming, conservation agriculture, agroforestry and Push-Pull technology. The latter two are considered in more detail in the Malawi and Kenya fieldwork sections below.

1.2 The advantages of ecological farming

© Greenpeace / Sven Torfinn. Farmer at Grow Bio-Intensive Agriculture Centre of Kenya garden. 2013.

Box 1: Greenpeace's guiding principles of ecological soil fertility

These are:

- **Reliance on organic fertilisers** (organic nutrient sources and legumes – biological nitrogen fixation). There are many proven agro-ecological practices to provide soil nutrition without the need for chemical fertilisers. However, under certain exceptional circumstances, mineral nutrients may be needed to restore soil fertility of degraded lands in the short term.
- **Increase efficiency in the use of organic fertilisers to minimise losses of nitrogen and phosphorus**. Ecological farming should aim at the best possible and most efficient use of resources, for example in the case of crop residue use after harvest. Crop residues form an important ingredient for returning soil nutrients and improving soil organic matter.
- **Return all manure and other food residues back to productive farm soils**. Ensure a balanced return of nutrients to productive croplands and pastures, by recycling manure and other wastes (including human waste, with well-designed and safe eco-sanitation).
- **Maintain or increase soil organic matter in agriculture soils**, as a crucial step in maintaining or improving soil fertility and optimising water use, resistance to drought stress and preventing erosion.
- **Integrate livestock farm animals in the agriculture system**; they help optimise the use and recycling of nutrients and can provide a farm working force. Ecological livestock relies on grasslands, pasture and residues for feed, instead of especially cultivated feed, minimising use of arable land and competition with land for human food production, whilst protecting natural ecosystems.

There is substantial evidence that ecological farming can **increase yields** significantly, often comparable to or greater than chemical-intensive agriculture. The largest study to date, led by Jules Pretty at the University of Essex in England, analysed 286 projects in which farmers in 57 countries were engaged in transitions to sustainable agriculture practices. It found that the average yield increase was around 79 per cent across a wide variety of crop types.[32] Many other studies provide similar conclusions.[33]

Ecological farming entails **lower production costs for farmers** as well as increased yields, and thus increased profit. Annex 1 outlines research that captures these substantial income benefits, with a particular focus on East Africa, and on agroforestry and Push-Pull approaches.

Ecological farming improves soil and water management by having a minimum negative impact on the environment and avoiding contamination of soil and water resources. It promotes the reduction of waste and pollutants and discourages burning. Ecological farming can also realise more food per unit of water by, for example, using more water efficient seed varieties and more water-efficient irrigation.[34]

Ecological farming **mitigates climate change** by eliminating dependence on fossil fuels, especially by reducing the use of nitrogen fertilisers. Practices such as composting and agroforestry help to sequester carbon dioxide in soils and increase soil organic matter. At the same time, the increased forestation and vegetation (such as cover crops) promoted by ecological farming, help mitigate carbon dioxide emissions from soils.

Ecological farming can also **enhance the resilience of vulnerable communities in the face of climate shocks**. Practises such as crop rotation, inter-cropping and polyculture (multiple cropping) increase the availability of food throughout the year, increase diversity in food production and tend to use seeds and breeds with higher tolerance to climate extremes, pests and diseases. These can reduce the risks of income losses from crop failures, compared to chemical-intensive agriculture.[35]

Farmers' and society's health can be improved by ecological farming because it often promotes a more diversified diet by producing many different food items, by using fewer pesticides, and by improving the availability of clean water.

© Greenpeace / Sven Torfinn. Small-scale farmer Mrs Gladys Wandia inspects her crops at her farm in Thika. 2013.

2. The Income Benefits of Ecological Farming in Kenya

Over 80 per cent of Kenya's population of 43 million live in rural areas and derive their livelihoods from agriculture and pastoralism.[36] Four million small-scale farm households produce three-quarters of the country's food. The key actors are women, who account for 75 per cent of the workforce in small-scale farming and play the major role in food preparation and storage.[37]

Yet farmers face massive challenges. Maize is the staple crop in the country and therefore vital to food security, but Kenya has a structural deficit in the production of maize and most small-scale farmers are net food buyers (buying more food than they sell).[38] Farmers' landholdings are small, productivity is low and many farmers have little access to financial services and markets to sell any surplus produce, while facing increasingly erratic weather. Around half the population, especially subsistence farmers and pastoralists, live in poverty and are unable to meet their daily food needs.[39]

2.1 Kenya's spending on agriculture, chemicals and ecological farming

Despite the importance of farming, the Kenyan government devotes only a small proportion of national budget spending to agriculture. It has allocated just 4-5 per cent of total spending to agriculture and rural development (which includes non-agricultural activities) in recent years, a percentage that has been declining.

Table 2: Kenya's agriculture budget

	2011/12	2012/13	2013/14
National budget figures – total	KES 53.0 billion ($630 million)	KES 51.4 billion ($600 million)	KES 47.5 billion ($551 million)
National budget figures - % of government budget	5.5	4.4	4.0

Sources: Republic of Kenya, *Budget Policy Statement*, April 2013 and April 2012, www.finance.go.ke; Republic of Kenya, *Medium Term Expenditure Framework 2011/12 – 2013/14*, January 2011, p.ix.
NB. Spending on 'Agriculture and Rural Development' means six ministries: those of Agriculture, Livestock Development, Fisheries Development, Cooperative Development and Marketing, Lands, and Forestry & Wildlife

© Greenpeace / Sven Torfinn. Small-scale agriculture on the premises of G-BIACK (The Grow Bio-intensive Agriculture Center of Kenya) is managed by Samuel Nderitu. 2013.

© Greenpeace / Sven Torfinn. Portrait of a small-scale farmer at composting area. 2013.

Within the agriculture budget, the government has since 2007 funded an input (fertilisers and seeds) subsidy programme – the National Accelerated Agricultural Inputs Access Programme (NAAIAP) – which reached 60,000 farmers in 2012[40] (though formally the programme aims to reach 2.5 million). In the 2014 planting season, the government distributed over 100,000 tonnes of subsidised fertilisers under the NAAIAP.[41]

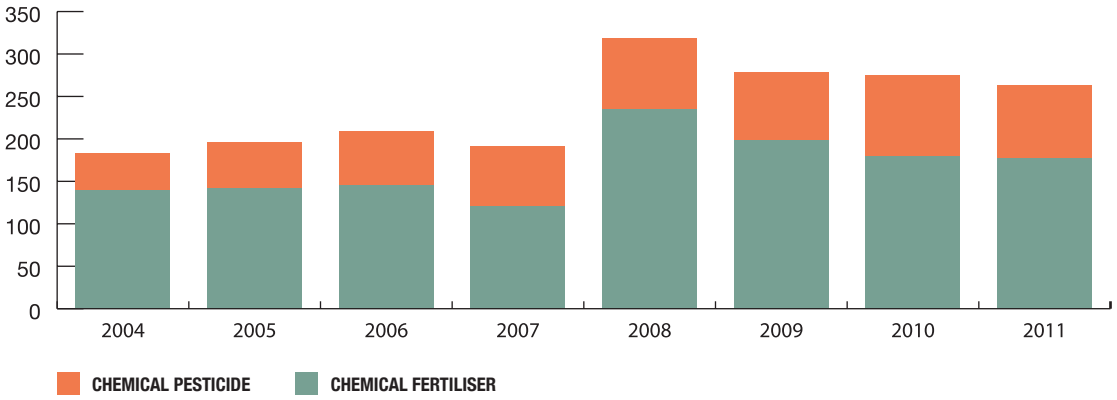
Precisely how much the government spends on the NAAIAP is unclear, since it does not publish regular, clear figures. However, a NAAIAP Secretariat source states that the budget was KES 4.0 billion for the 5 years 2007/08 – 2011/12 and KES 2.95 billion ($34.3 million) in 2012/13.[42] The government has announced plans to spend KES 3 billion ($34.9 million) on the subsidy programme in 2014/15.[43] Thus spending on the NAAIAP amounts to around 6 per cent of the agriculture and rural development budget.

Kenya imports much larger quantities of chemical fertilisers and pesticide, shown in table 3 below.

The government recognises that the cost of fertilisers is high and is planning to build a fertiliser manufacturing plant, beginning with the production of nitrogen, phosphorus and potassium.[44] The cost of this factory is reportedly a massive KES 38 billion ($442 million).[45] Another indication of the priority given to promoting chemicals is the announcement by the Agriculture Minister in October 2013 that the government has established a Fertiliser and Seed Development Fund with an initial investment of KES 5 billion ($58 million) which will increase to KES 20 billion ($233 million) in the next five years.[46]

Government figures do not make clear how much it spends on ecological farming, but there is no indication it is anything like the level spent, or is planned to be spent, on promoting chemicals. A review of key budget documents suggests that Kenya is promoting agroforestry, climate adaptation and conservation agriculture. But Kenya's *Agriculture Sector Development Strategy, 2010-20*, states that fertiliser use is 'low' and that 'credit packages' will be made available to farmers to increase their access to chemical fertilisers. It also states that agroforestry will be promoted as part of sustainable land management but only briefly mentions organic farming and does not mention Integrated Pest Management or Push-Pull technology.[47]

Table 3: Kenyan imports of chemical fertilisers and pesticide ($ million)



Source: FAOStat; http://faostat3.fao.org/faostat-gateway/go/to/home/E

© Greenpeace / Sven Torfinn. Staff at the International Centre of Insect Physiology and Ecology measure the height of plants every two weeks to compare maize grown with standard fertiliser and organic compost. 2013

© Greenpeace / Sven Torfinn. Small-scale farmers Mr Kariuki and Mrs Gladys Wandia inspect their banana crop. 2013.

2.2 Push-Pull technology and our fieldwork in Kenya

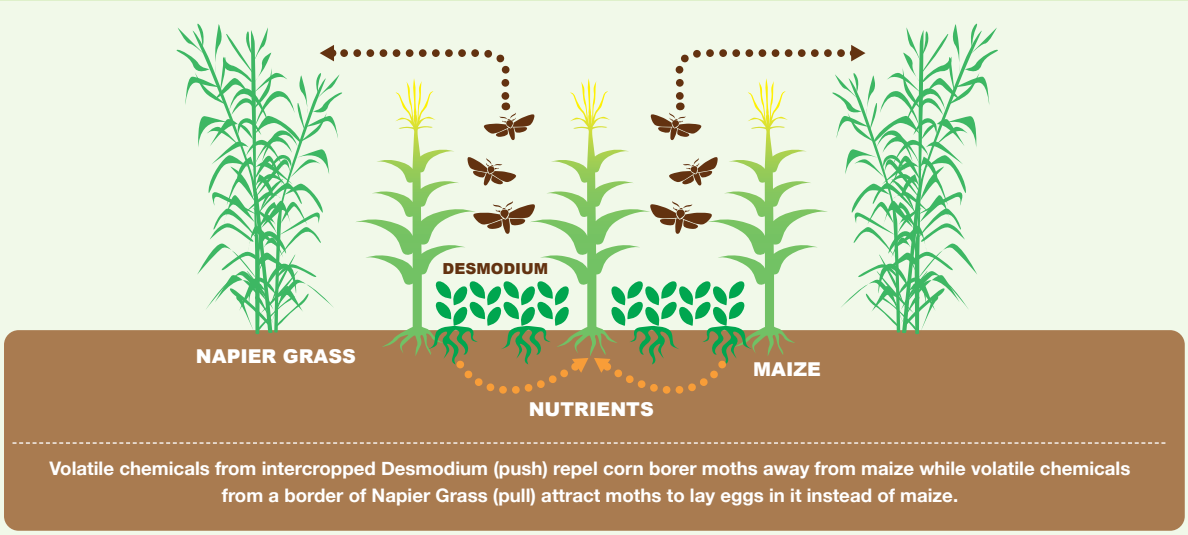
Push-Pull technology is a form of ecological farming practised by around 89,000 farmers in East Africa, farmers mainly in Kenya, supported by ICIPE (see box 2).[48] Our fieldwork measured the costs and benefits of practising Push-Pull compared to the absence of Push-Pull and to using chemicals inputs.

Box 2: What is Push-Pull Technology?

Push-Pull Technology is a form of conservation agriculture to control parasitic weeds and insects that damage crops and has been developed by the International Centre for Insect Physiology and Ecology (ICIPE) in Kenya and in the UK.[49] Under chemical-intensive agriculture massive losses in food production are caused by pests such as stemborers and parasitic striga weeds, and poor soil fertility. Losses caused by stemborers reach an average of about 15-40 per cent, while losses attributed to striga weeds can be 30-100 per cent.

'Push-Pull' technology involves intercropping maize (mainly, but also other crops such as sorghum) with a repellent plant, such as desmodium, and planting an attractive trap plant, such as Napier grass, as a border crop around this intercrop.[50] Push-Pull is affordable for small-scale farmers, since it is based on locally available plants, inexpensive external inputs, and fits well with traditional mixed cropping systems.[51] Maize yields, according to ICIPE, have increased from around 1 ton per hectare to 3.5, achieved with minimal inputs.[52]

A further benefit of Push-Pull is that plants such as desmodium are fodder shrubs, providing easily available protein feeds for dairy animals. The incorporation of fodder shrubs into daily animal rations increases milk production and reduces feed shortages in the dry season. In addition, desmodium fixes nitrogen, improving soil fertility and discouraging the striga weed, which favours impoverished soils.[53]



Fieldwork was conducted in Kenya in June 2014, gathering data in structured one-to-one interviews from four groups of farmers. A team of two Greenpeace researchers, joined by staff and field workers of ICIPE, met groups of farmers who were made aware of our visit in advance and gathered in groups of between 6 and 12. They were then interviewed individually, away from other farmers so as not to intrude on their privacy when answering personal questions. Interviews were conducted with the help of an interpreter where necessary.

Farmers in two areas were interviewed:

- In Kitale, in the far west of Kenya near the Ugandan border, interviews were held with 23 female and male farmers practising Push-Pull without the use of chemical pesticides and 15 farmers using chemicals, including pesticides.
- In Mbita, in south-western Kenya near Lake Victoria, interviews were held with 22 female and male farmers practising Push-Pull without the use of chemical pesticides and 19 farmers not practising Push-Pull and not necessarily using chemicals.

The four groups of farmers have maize holdings averaging 1.3–2.1 acres. Some grow maize purely for home consumption while others regularly sell in local markets. Nearly all the farmers practising Push-Pull in Kitale and Mbita also grow maize not using Push-Pull on some areas of their farm; our figures below disaggregate this difference.

Income benefits

We found that that the average profitability per acre of maize per year (meaning the value of production minus costs*) in Kitale was KES 51.542 ($588)[54] for Push-Pull farmers and KES 16,930 ($193) for chemical farmers – three times greater and a difference of $395 per acre. In Mbita, average profitability was KES 37,973 ($433) for Push-Pull farmers and KES 12,454 ($142) for non-Push-Pull farmers – also three times greater and a difference of $291 per acre. This extra income is hugely significant in Kenya where average annual incomes are just $456 a year and much lower in rural areas.[55]

The income benefits were even greater among female farmers:

- The average profitability per acre of maize in Kitale was KES 55,345 ($632) for Push-Pull female farmers and KES 16,716 ($191) for chemical farmers – over three times greater.
- In Mbita, average profitability was KES 42,418 ($484) for Push-Pull female farmers and KES 9,690 ($111) for non-Push-Pull farmers – over four times greater.

Table 4a: Profitability (value of production negative costs per acre) for all farmers and female farmers in Kitale

	Kitale Push-Pull Farmers	Kitale Chemicals Farmers	Difference
Profitability– all farmers			
Maize	KES 51,542 ($588)	KES 16,930 ($193)	KES 34,612 ($395)
Beans	KES 8,590 ($98)	KES 5,806 ($66)	KES 2,784 ($32)
Profitability– female farmers (maize)	KES 55,345 ($632)	KES 16,716 ($191)	KES 38,629 ($441)

Table 4b: Profitability (value of production negative costs per acre) for all farmers and female farmers in Mbita

	Mbita Push-Pull Farmers	Mbita Non-Push-Pull Farmers	Difference
Profitability– all farmers	KES 37,973 ($433)	KES 12,454 ($142)	KES 25,519 $291
Profitability– female farmers	KES 42,418 ($484)	KES 9,690 ($111)	KES 32,728 $373

In fact, the income gains are even larger for Push-Pull farmers since most earn extra income by selling desmodium and napier plants, used in practising Push-Pull, for animal fodder. Of the 23 Kitale Push-Pull farmers, 13 made money from such sales, averaging KES 6,450 ($74) per farmer. By contrast, only one of the Kitale chemical farmers sold napier. (These figures are not included in the average profitability figures noted above, which focus on crop production).

Box 3: Possible income gains for Kenya

The income benefits of practising Push-Pull are very significant in rural Kenya where average incomes are low. Our findings are that a farmer with two acres of maize grown using Push-Pull could increase her/his annual income by $790 in Kitale and $582 in Mbita. If this were applied nationally, farmers would gain an average (between Kitale and Mbita) of $686 – this would double or triple incomes for many farmers, given average annual incomes in Kenya of just $456.[56] The gains for Kenya's four million farmers (assuming each is farming two acres) would total $2.7 billion, a huge injection of revenues into rural areas.

In addition, Push-Pull benefits local economies by farmers using locally available inputs, like napier grass seedlings and desmodium seeds. This means money stays in the local economy to pay for seed breeding or labour. By contrast, money spent on chemical fertilisers leaves the local economy and goes largely to manufacturing companies.

* This is not the same as income. The value of production is the worth of maize produced if sold (which it often is not).

Labour time

It is often believed that ecological farming requires more labour time and labour costs than chemical-intensive farming. Our research challenges this:

- In Kitale, a smaller number of Push-Pull farmers incur labour costs than chemical farmers (61 per cent compared to 80 per cent). The average farm spending on labour costs is lower for Push-Pull farmers in Kitale (KES 2,557 /$29) than for chemical farmers (KES 4,331/$49).
- In Mbita, the picture is different in that more Push-Pull farmers spend money on more labour costs than among non- Push-Pull farmers. Yet the difference in average labour costs between Push-Pull and non- Push-Pull farmers in Mbita is quite small – KES 1,840 ($21) per farm.

Yield benefits

- Average yields for maize grown using Push-Pull were 2,280 kgs per acre in Kitale and 745 kgs in Mbita. This compares to yields of 1,167 kgs and 334 kgs for non-Push-Pull farmers in Kitale and Mbita respectively.
- Thus Push-Pull farmers in Kitale grow an average of 1,113 kgs of maize per acre more than chemical farmers. In Mbita, the yields of Push-Pull farmers are more than double those of non-Push-Pull farmers.

Most Push-Pull farmers growing maize using both Push-Pull and non- Push-Pull approaches report higher yields using Push-Pull – 68 per cent in Kitale and 90 per cent in Mbita. Average profitability per acre is also much larger for maize grown using Push-Pull than not using it.

Table 5a: Yields – male farmers and female farmers in Kitale

	Kitale Push-Pull Farmers	Kitale Chemicals Farmers	Difference
All Farmers			
Average maize holding (acres)	1.8	2.1	-0.3
Yields			
Average maize yield (kgs per acre)	2,280	1,167	1,113
Average beans yield (kgs per acre)	134	155	-21
Number of months for which family can be fed by own production	9.5	10.2	-0.7 additional months
Female Farmers			
Average maize holding (acres)	2.0	1.6	0.4
Yields			
Average maize yield (kgs per acre)	2,347	1,172	1,175

© Greenpeace / Jennifer Heslop. Mrs Ouso showing maize that benefited from napier grass and the desmodium. Suba District, Kenya. 2000.

Table 5b: Yields – male farmers and female farmers in Mbita

	Mbita Push-Pull Farmers	Mbita Non-Push-Pull Farmers	Difference
All Farmers			
Average maize holding (acres)	2.1	1.3	0.8
Yields			
Average maize yield (kgs per acre)	745	334	411
Number of months for which family can be fed by own production	10.9	5.6	5.3 additional months
Female Farmers			
Average maize holding (acres)	2.2	1.2	1
Yields			
Average maize yield (kgs per acre)	889	288	601

Lower production costs

The income benefits of practising Push-Pull are explained by a combination of better yields and lower costs of production. In terms of the costs:

- Push-Pull farmers in Kitale spend nothing on chemical pesticides and a relatively small amount on chemical fertilisers – KES 3,852 ($44) on average.
- By contrast chemical farmers in Kitale spend an average of KES 13,002 ($148) on chemical fertilisers and KES 920 ($11) on pesticides.
- Overall, Push-Pull farmers in Kitale incur costs representing 14 per cent of the value of their production whereas for chemical farmers the figure is 45 per cent.

© Greenpeace / Sven Torfinn. Small-scale farmer Gladys Wandia holds beans grown on her farm in Thika. 2013.

Table 6a: Costs of production in Kitale

	Kitale Push-Pull Farmers	Kitale Chemicals Farmers	Difference
Costs			
Maize farmers average costs as % of production	14%	45%	-31%
Average spending on chemical pesticides on maize	KES 0	KES 920 ($11)	-KES 920 ($11)
Average spending on chemical fertilisers on maize	KES 3,852 ($44)	KES 13,002 ($148)	-KES 9,150 ($104)
Percentage of farmers spending nothing on fertilisers	52%	0%	52%
Average spending on labour costs on maize	KES 2,557 ($29)	KES 4,331 ($49)	-KES 1,774 ($20)
Percentage of farmers incurring labour costs	61%	80%	-19%
Percentage of farmers borrowing money	50%	54%	-4%
Average loans for those farmers borrowing money	KES 24,273 ($277)	KES 39,857 ($455)	-KES 15,584 ($178)

Table 6b: Costs of production in Mbita

	Mbita Push-Pull Farmers	Mbita Non-Push-Pull Farmers	Difference
Costs			
Maize farmers average costs as % of production	17%	44%	-27%
Average spending on chemical pesticides on maize	KES 0	KES 53 ($1)[57]	KES 53 ($1)
Average spending on chemical fertilisers on maize	KES 3,475 ($40)	KES 1,943 ($22)	KES 1,532 ($18)
Percentage of farmers spending nothing on fertilisers	45%	47%	-2%
Average spending on labour costs on maize	KES 3,714 ($42)	KES 1,874 ($21)	KES 1,840 ($21)
Percentage of farmers incurring labour costs	77%	47%	30%
Percentage of farmers borrowing money	50%	17%	33%
Average loans for those farmers borrowing money	KES 49,000 ($559)	KES 15,333 ($175)	KES 33,667 ($384)

Scaling up Push-Pull

Push-Pull farmers in Kitale and Mbita were also asked what they believed were the benefits of practising Push-Pull. Replies were as follows (farmers could give more than one answer):

	Kitale (23 farmers)	Mbita (15 farmers)
Higher production/yield	13	11
Fodder production	10	12
Reduced impact of pests	10	9
Increased soil fertility/less erosion	4	8
Saves money	3	3
Reduces need for chemicals	2	0
Higher milk yields	2	0
Others	3	1

Our research finds that if the government provided more support to Push-Pull through its agricultural extension service, more farmers could practise it, increasing their incomes. We asked farmers whether they received any support (training or inputs) from the government. Out of the 23 Kitale Push-Pull farmers, only one receives a fertiliser subsidy, and another extension support, but 21 said they received no support. Of the 15 Kitale chemical farmers, seven said they received training or subsidised fertiliser and seven said they received no support (one was not asked). Nine of the Kitale chemical farmers were asked why they were not practising Push-Pull – the most common answer (mentioned by six farmers) was that they needed training to take up Push-Pull. Some farmers heard about Push-Pull through NGOs, not the government.

There are various reported barriers to push-pull adoption. In our research, farmers told us of both physical and social barriers. Physical barriers include the volatile chemicals given off by the intercropped plants not working over a large area (many plots), the perennial nature of the intercropped plants which means that there is no ability to rotate crops, Napier grass stunt disease and there has been a shortage of desmodium seed. Reported social barriers include the farmers not realising the benefits of push-pull as they do not keep detailed records.

2.3 Implications for the government

The Kenyan government should increase its support to ecological farming, including Push-Pull, through increased budgetary allocations, advice and training (including of extension officers), and research and development. Such support is likely to be more cost-effective for the government, and more profitable for farmers, than subsidising or using chemical fertilisers, or building an extremely expensive fertiliser manufacturing plant.

© Greenpeace / Sven Torfinn. Small-scale farmer Mr Kariuki inspects his maize crop. 2013.

© Greenpeace / Jennifer Heslop. Young crops of maize and silver leaf desmodium, ICIPE field station Mbita Point, Suba District, Kenya. 2000.

3. The Income Benefits of Ecological Farming in Malawi

Malawi has become well-known for its large-scale fertiliser subsidy programme. This has increased yields for many small-scale farmers in a country who previously suffered deep food insecurity crises. However, our research shows that agroforestry provides greater benefits to small-scale farmers at less cost.

Over 90 per cent of Malawi's rural population (2.5–3 million households) are small-scale farmers cultivating an average landholding of 2 acres (0.8 hectares). Most of the land is planted with the main staple food, maize, of which Malawi is now usually able to produce around three million tons, which is above the self-sufficiency level of 2.3 million tonnes. However, due to unequal production and distribution of this maize production, many families go hungry for several months a year.[58] Some 51 per cent of Malawi's population live below the national poverty line, while average life expectancy is just 55.[59]

3.1 Malawi's spending on agriculture, chemicals and ecological farming

Unlike Kenya, Malawi is one of seven of Sub-Saharan Africa's 49 countries that have consistently reached the target set by African heads of state to spend 10 per cent of their national budgets on agriculture.[60] However, a very large proportion of Malawi's agriculture budget goes to the Farm Input Subsidy Programme (FISP) – which since 2005 has provided subsidised fertiliser and seed to small-scale farmers to increase the production of maize.[61] Spending on the FISP was a massive 51 per cent of the agriculture budget in 2012/13 and 43 per cent in 2013/14.[62] This amounts to around 9 per cent of Malawi's entire national budget in both years.

Table 7: Malawi's agriculture budget and spending on the FISP

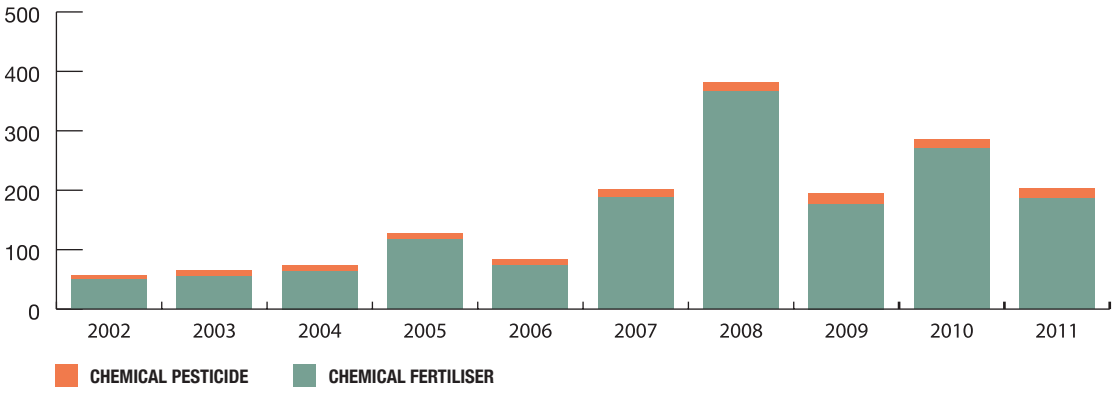
	2012/ 13	2013/ 14
Agriculture budget	MK 87.2 billion ($268 million)	MK 126.5 billion ($313 million)
Percent of government budget	18.3%	20.1%
Fertiliser subsidy[63]	MK 44.2 billion ($136 million)	MK 54.6 billion ($135 million)
Fertiliser subsidy (% of ag budget)	51	43

Sources: Figures for 2012/13 and 2013/14 from Government of Malawi, *2013/14 Financial Statement*, p.27. Figure for 2011/12 from *2012/13 Financial Statement*, p.22 http://www.finance.gov.mw/index.php?option=com_docman&Itemid=107; Government of Malawi, *2013/14 Financial Statement*, p.21, http://www.finance.gov.mw/index.php?option=com_docman&Itemid=107
NB. These are figures for spending by the Ministry of Agriculture and Food Security. 'Local Government and Rural Development' is a separate ministry which supports activities in rural areas that can support farmers but which are not agriculture as such.

These figures likely under-estimate the costs of the FISP, since they do not include the substantial time spent by extension officers in administering the programme.[64] Donors funded 17 per cent of the costs of the FISP in the five years 2007/08 – 2011/12, amounting to around $129 million, compared to a government contribution of around $640 million.[65]

Not surprisingly, Malawi has become a substantial importer of chemical fertilisers and pesticides since beginning the FISP. The country spent over $1.5 billion on fertiliser imports and $135 million on pesticides in the 10 years from 2002-11, as outlined in the table below.

Table 8: Malawi's fertiliser and pesticide imports ($ million)



Source: FAOStat (http://faostat3.fao.org/faostat-gateway/go/to/home/E)

Although Malawi's agriculture budget does not provide details on all areas of spending, the figures available suggest that the budget allocation to the FISP is ten times greater than spending on ecological farming. Malawi's flagship agriculture strategy document – the *Agriculture Sector Wide Approach: Malawi's prioritised and harmonised agricultural development agenda*, of September 2010[66] – outlines a FISP budget of $620 million for the 4 years 2010/11 – 2013/14 compared to just $57 million for 'sustainable agricultural land management' (which includes promoting conservation farming and agroforestry). (see Annex 2).

3.2 Agroforestry in Malawi and our fieldwork

Malawi launched an Agroforestry Food Security Programme in 2007 managed by the Ministry of Agriculture together with the World Agroforestry Centre (ICRAF), the Malawian Farmers' Association and a number of NGOs. It provides tree seeds and training to farmers to work with a range of agroforestry species, including fertiliser trees, which improve the condition of soil used for farming, especially to increase maize production. Support from the Irish government has enabled the programme to expand to 40 per cent of Malawi's districts, involving at least 200,000 families or around 1.3 million of the poorest people.[67]

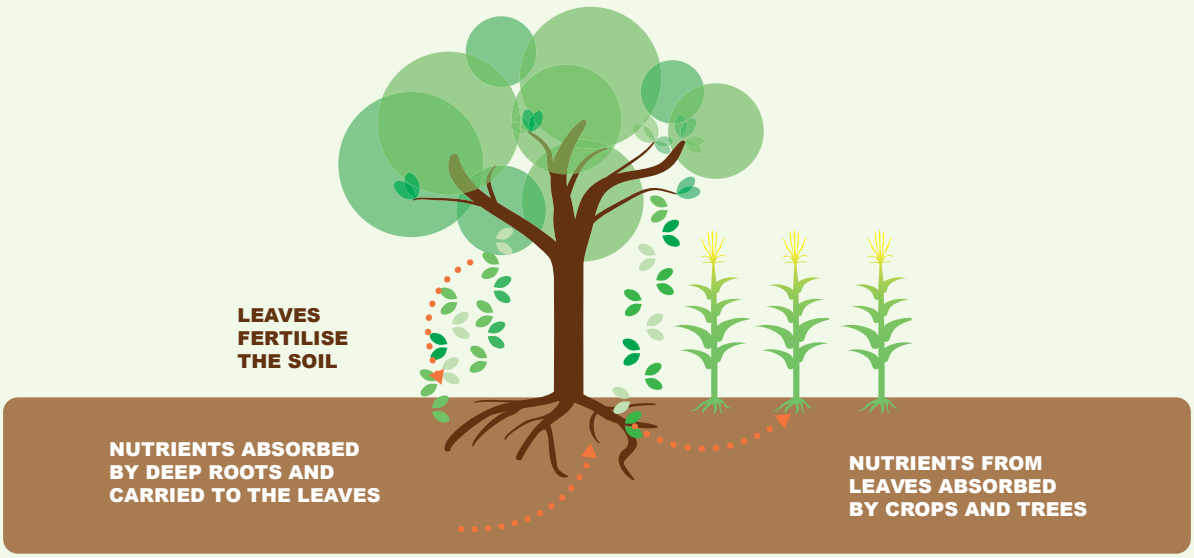
Box 4: What is agroforestry?

Agroforestry incorporates trees into agricultural systems. Among these are fertiliser trees for land regeneration, soil health and food security; fruit trees for nutrition; fodder trees that improve small-scale livestock production; timber and fuelwood trees for shelter and energy; medicinal trees to combat disease; and trees that produce gums, resins or latex products.[68] The World Agroforestry Centre notes that the livelihood and environmental benefits include:

- Enriching the asset base of poor households with farm-grown trees.
- Enhancing soil fertility and livestock productivity on farms.
- Linking poor households to markets for high-value fruits, oils, cash crops and medicines.
- Balancing improved productivity with the sustainable management of natural resources.
- Maintaining or enhancing the supply of environmental services in agricultural landscapes for water, soil health, carbon sequestration and biodiversity.[69]

This method of agriculture is also referred to as Evergreen Agriculture, on which more information is available at: www.evergreenagriculture.net.

In this study, most farmers used agroforestry with fertiliser trees. Farmers predominantly use the Faidherbia Albida tree. This tree drops its leaves at the beginning of the growing season, fertilising the soil, and the crop therefore does not need to compete with the tree for sunlight.



Research was conducted in Salima district of central Malawi in April 2014 to compare the costs and benefits to small-scale farmers of using either chemical inputs or agroforestry. A team of three Greenpeace researchers, joined by staff and field workers of partner organisations Total Land Care and ICRAF, did structured face-to-face interviews using a questionnaire. The team met groups of farmers who were made aware of our visit in advance and gathered in groups of between 6 and 12. They were then interviewed individually, away from other farmers so as not to intrude on their privacy when answering personal questions. As in Kenya, interviews were conducted with the help of an interpreter where necessary.

Our fieldwork took data from two groups of farmers - 38 farmers practising agroforestry on maize (using no chemical fertilisers) and 45 farmers using chemical fertilisers. The two groups had similar land holdings allocated to maize – an average of 1.6 acres in the case of the agroforestry farmers, and an average of 1.5 for those using chemical fertilisers. The farmers in both groups were a mix of those growing maize purely for home consumption and those selling maize in local markets.

Most of the agroforestry farmers have been practising agroforestry for the past few years, and only some for longer. All except one use faidherbia trees while some have acacia; some of the trees have been planted by farmers, while others grow naturally. To fertilise the soil, most agroforestry farmers use only their fertiliser trees and nothing else, while some use animal manure.

Income

We found that the average profitability per acre of maize (value of production minus costs) was MK 101,884 ($259)[70] for agroforestry farmers and MK 65,5208 ($166) for chemical farmers – a difference of $93 per acre.[71] This is a significant sum in rural Malawi, amounting to around one third of average per capita annual income (which is around $270[72]).

Female agroforestry farmers are also much better off than those buying chemical fertilisers. Their average profitability per acre of maize is MK 85,116 ($216) compared to only MK 54,784 ($139) for those using chemical fertilisers.

Importantly, our findings also show that farmers practising agroforestry are better off than those accessing subsidised fertiliser under the FISP. Although our sample size was small, suggesting the need for further research, we found that the average profitability per acre of maize for farmers using subsidised fertiliser is less than half ($81) that of farmers practising agroforestry ($166). Overall, our field research shows that agroforestry is a better investment for the government than subsidising fertilisers.

A key reason for these income benefits is that farm costs (notably for buying chemical fertilisers) are much lower for agroforestry farmers than for those using chemicals – 9 per cent of the value of production compared to 32 per cent. Another reason is that the maize yields of agroforestry farmers are higher: 1,137 kgs per acre compared to only 828 kgs per acre for chemical farmers. The increased production by agroforestry farmers means they are able to feed their families for longer than chemical farmers – for 10 months of the year, compared to 9 months for those using fertilisers.

We asked farmers how much money they saved by practising agroforestry. The seven that replied said they saved an average of MK 134,000 ($340) a year by not buying fertilisers.

Box 5: Possible income gains for Malawi

Our findings that farmers earn $93 extra per acre by practising agroforestry than by using chemical fertilisers could translate into large gains to Malawi as a whole. If it were possible for the 1.5 million farmers currently using chemical fertilisers to switch to agroforestry, they could earn a combined $209 million extra income.[73] In addition, the government would no longer need to spend $135 million a year on the FISP. The combined gains to Malawi could be $344 million – much larger than Malawi's entire agriculture budget. These savings could be invested in supporting agroforestry and other forms of ecological farming so that income gains for farmers are even larger.

There are additional gains to the local economy from agroforestry in that tree nurseries provide local employment and farmers' spending on tree seedlings means that money stays in the local economy, a stark difference to money spent on imported fertiliser, which benefits fertiliser manufacturing companies.

Debt

Our findings are that chemical farmers have larger debts. We asked both groups of farmers whether they had borrowed money in the past two years or if they currently owed any money. Some 14 per cent of agroforestry farmers said they had taken out loans worth an average of MK 15,667 ($40) and all said they had paid those loans back. By contrast, 44 per cent of chemical farmers had taken out a loan, borrowing an average of MK 23,607 ($60) each.

Labour time

Our research in Malawi found that ecological farming requires less labour time and labour costs than using chemicals. More farmers buying chemicals (29 per cent) incurred labour costs on their farm (for all crops including maize) than those practising agroforestry (21 per cent). We asked 30 of the agroforestry farmers if extra labour time was needed: 26 said no and three said yes (with one indeterminate). Of the three who said yes, two said that extra labour time was only needed when they began to practice agroforestry. This refers to the initial planting of trees and farmers needing to tend to them when young.

Our fieldwork findings are summarised in table 9 below.

Table 9: Summary of Malawi research findings

	Agroforestry farmers	Chemical fertiliser farmers	Difference
All farmers			
Sample (number of maize farmers)	38	45	-7
Average maize holding	1.6 acres (range 0.5 – 5)	1.5 acres (range 0.5 - 3)	0.1 acres
Profitability per acre of maize (value of production minus costs)[74]	MK 101,884 ($259)	MK 65,520 ($166)	MK 36,364 ($93)
Average farm spending on chemical fertilisers for maize	0	MK 20,509 ($52)	-MK 20,509 ($52)
Average maize yield	1,137 kgs per acre (range 125 – 3,500)	828 kgs per acre (range 175 – 2,000)	309 kgs per acre
Farm costs (maize seed, fertilisers, pesticides, labour) as proportion of value of maize production	9.1%	32.5%	-23.4%
Number of farms incurring labour costs	8/38 (21%)	13/45 (29%)	-8%
Farm spending on food costs per year	MK 141,738 ($360)	MK 115,805 ($294)	MK 25,933 ($66)
Total income from farm production[75]	MK 129,996 ($330)	MK 68,732 ($174)	MK 61,264 ($156)
Months for which farm-produced maize produces sufficient food for the family	10.3	8.9	1.4
Percentage of farmers only consuming, not selling maize (subsistence)	47%	51%	-4%
OF WHICH:			
Female farmers			
Sample (number of female farmers)	19	18	1
Average maize holding	1.4 acres	1.4 acres	0
Average maize yield	918 kgs per acre	690 kgs per acre	228 kgs per acre
Farm costs as a proportion of the value of maize production	10%	26%	-16%

Profitability per acre (value of production minus costs)	MK 85,116 ($216)	MK 54,784 ($139)	MK 30,332 ($77)
Average farm spending on chemical fertilisers for maize	0	MK 11,892 ($30)	- MK 11,892 ($30)
Farmers buying subsidised fertilisers under the FISP			
Sample (number of farmers)	NA	6	
Average maize holding	NA	1.25 acres	
Average maize yield	NA	398 kgs per acre	
Farm costs as a proportion of the value of maize production	NA	8 per cent	
Profitability per acre (value of production minus costs)	NA	MK 31,009 ($81)	

Benefits of agroforestry

We asked 35 agroforestry farmers what benefits they observed practising agroforestry. The four most commonly identified benefits were:

- Improved yield (20)
- More firewood (10)
- Better soil fertility (8)
- Improved water conservation (2)

When asked if there were any negative impacts of agroforestry, most farmers mentioned nothing while nine mentioned thorns and tree shade.

We also asked farmers using chemical fertilisers what benefits they had noticed from others practising agroforestry, to which 23 responded:

- Improved yield (10)
- Better soil fertility (7)
- No need/less need for chemical fertilisers (3)
- Other (3)

3.3 Implications for the Malawian government

Our findings suggest that agroforestry is more profitable for farmers than using chemical fertilisers and that most farmers using chemical fertilisers would switch if the government supported the transition to agroforestry. The Malawian government should increase its support to ecological farming, including agroforestry, through increased budgetary allocations, advice and training (including of extension officers), and research and development. Such support is likely to be more cost-effective for the government, and more profitable for farmers, than subsidising or using chemical fertilisers.

A switch from subsidising fertilisers to investing more in agroforestry has been recommended by, among others, the previous UN Special Rapporteur on the Right to Food, Olivier de Schutter.[76] This has also been suggested by the government itself in its Agriculture Sector-Wide Approach, which sees organic farming as an exit strategy for the FISP. For this to happen, however, much greater investments in ecological farming is required, as well as and big reductions in, and eventual abolition of, the fertiliser subsidy.

© Greenpeace / Lasse Van Aken. An agroforestry field in Malawi. Mike Mkandawire, a field officer from Total Land Care explains the agroforestry system, Malawi. 2014.

4. Inadequate Government Support to Ecological Farming

The adverse impacts of chemical-intensive agriculture are increasingly recognised. Many international actors are now calling for the adoption of forms of ecological farming – these include UNEP[77], FAO[78], UNCTAD[79], IFAD[80], the UN Special Rapporteur on the Right to Food[81] and the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), a unique three-year, inter-governmental assessment of Agricultural Knowledge, Science and Technology that was endorsed by 58 governments[82].

But the record of national governments in promoting ecological farming is very mixed. Some governments in Latin America and Asia have gone furthest (though still not far enough) in promoting ecological farming. For example:

- In **Brazil**, a 2010 Act prioritises support to rural extension activities in ecological farming and the agricultural research corporation (EMBRAPA) has programmes on agro-ecology.[83]
- **Cuba** has long promoted ecological farming and organic farming, including in urban areas, based on strong farmer to farmer networks, disseminating knowledge through participatory approaches and government support.[84]
- The **Philippines** stopped its fertiliser subsidy programme in 2009 and now aims to promote a balance of chemical and organic fertilisers, which includes some subsidies for using organic fertilisers.[85]

Unfortunately, governments are failing adequately to promote and fund ecological farming. A good illustration of this is the fact that only one country – India – has so far adopted a cohesive national policy on agroforestry, and this was approved only in February 2014.[86] In Africa, most governments are giving very low priority to supporting ecological farming compared to their support for chemical input use. Most governments' agriculture budgets do allocate a small portion of funds to programmes on soil conservation and land management, for example, but little money or extension support appears to be going to ecological farming practices such as agroforestry or Push-Pull technology. For example:

- In **Ghana**, the government's input subsidy programme – which provides subsidised chemical fertilisers to farmers – accounted for a massive 79 per cent of spending on agriculture during 2008-11.[87] By contrast, government support to organic farming, for example, is at a very low level, reaching few farmers.[88]
- In **Zambia**, although the government encourages conservation farming – which is practised by around 270,000 farmers on portions of their land[89] - spending on ecological farming and adaptation to climate change is probably less than 1 per cent of the agriculture budget.[90] By contrast, the government's Farm Input Subsidy Programme, which provides cheap chemical fertilisers to farmers, accounted for over a quarter of the agriculture budget in 2013.[91]
- In **Uganda**, the government recognises the importance of sustainable land management, for example, but the Development Strategy and Investment Plan for Agriculture (DSIP) allocates only 3.8 per cent of its budget to this area.[92]

Box 6: The Lusaka Declaration on Organic Agriculture

In May 2012, 300 participants from 35 countries published the Lusaka Declaration on Mainstreaming Organic Agriculture into the African Development Agenda.[93] This recognises the key role that organic agriculture contributes in bringing about sustainable development, food security and climate change adaptation. The declaration states that the adoption of organic agriculture significantly increases yields and improves livelihoods and food security in Africa. It also notes that organic agriculture is climate-smart because it produces lower emissions and promotes resilience in times of climate extremes such as drought and heavy rains. The declaration calls upon the African Union and all member states to include organic agriculture into their national policies; unfortunately, it remains unimplemented across the continent.

Box 7: Barriers to adopting ecological farming

There are various reasons why governments and farmers may be deterred from making the transition to ecological farming. One is that many governments remain to be convinced that ecological farming can be more profitable than chemical-intensive farming. Another is simply political will – even given the evidence in favour of ecological farming, governments still find political or bureaucratic reasons for failing to make the change, or else see subsidy programmes as a way to gain votes in rural areas.

For farmers, the barriers to adopting ecological farming can include:

- the existence of financial incentives to use chemical inputs, such as fertiliser subsidies
- product advertising coupled with extension officers pushing the benefits of chemicals, which can deter farmers from moving away from chemical farming methods
- lack of adequate information and knowledge on how to transition switch to ecological farming
- insecure land property rights, which can deter farmers from making investments in their farming and soil
- lack of capacity in local extension services to work with farmers to promote farming approaches adapted to local conditions.[94]

In our field research in Malawi, we asked farmers using chemical fertilisers why they were not practising agroforestry, to which 45 responded:

- Lack of knowledge/don't know how (9)
- Lack of water for trees (9)
- Lack of seedlings (7)
- Not interested (3)
- Termites attack trees (2)
- No specific reason/other (15)

These answers contrast strongly to Malawi's subsidy programme in which knowledge and seed is passed on to farmers. It shows that the take-up of agroforestry could be much larger. Indeed, we also asked Malawian farmers using chemical fertilisers whether they would practice agroforestry if the government supported it. Of the 45 who responded, 41 said yes and only 3 no (with 1 indeterminate).

We further asked those farmers what kind of support they would like: (farmers could give more than one answer):

- Extension/training (19)
- Seeds (19)
- 'Inputs' (not specified) (12)
- Equipment (tubes, watering can) (9)
- Water/irrigation (8)
- Others (2)

© Greenpeace / Lasse Van Aken. After the interviews, interviewees and their families rest at the village square. Malawi. 2014.

5. Recommendations

5.1 How should governments support and subsidise ecological farming?

'Governments may consider phasing out, through 20 to 25 per cent annual reductions over a time-bound period of, for example, five to 10 years, subsidies on soil-depleting agro-chemicals and inorganic nitrogenous fertiliser whose excessive use is incrementally destroying the vital biological quality of soil contributing to global warming and impoverishing farmers. Subsidies thus saved could instead be used as cash incentives to support farmers in offsetting initial risks (two to three years) associated with the local generation of bio-fertilisers, and to build up national agricultural capital of soil and water for sustainable agricultural productivity. Such phasing out, complemented by subsidies for bio-fertilisers, could be part of targeted government policy towards rejuvenating and converting national cultivable land to ecologically sound, economically viable and sustainable food production'. (UN Commission on Asia and the Pacific[95])

The broad approach

Governments should take the following broad steps to shift public subsidies from chemicals to organic fertilisation:

- **Establish targets to reduce and then eliminate the use of chemicals**. Research should be undertaken showing how this can be done and over what timeframe, using interim targets. As part of this, chemical subsidies should be phased out in favour of using public funds to support ecological farming. Other policies that incentivise the use of chemicals, such as tax policies that reduce the costs of fertilisers, should be changed; such tax policies are in effect public expenditure, since they can reduce tax revenues.
- **Drastically increase national budgets devoted to supporting ecological farming**. The increased finance can come from phased out chemical subsidies, and other sources such as wastages in public financing, reductions in military spending (in some countries) and the recovery of lost revenues from tax evasion.[96] Government should also disaggregate and track budget spending on ecological agriculture to assess and increase support for this over time.
- **Draw up Ecological Farming Strategies** that include plans for phasing out fertiliser subsidies and the use of other chemicals such as pesticides. In some countries, this means beginning a transition, but for most, such as Kenya and Malawi, it means expanding currently low-level attempts to promote ecological farming into a comprehensive state policy.
- **Promote and enhance the use of organic fertilisers**, and to provide supportive and enabling policies to achieve this (see box 8). Chemical fertilisers are usually only affordable to poor, small-scale farmers when they are subsidised.

Box 8: Supporting critical ecological/organic fertilisation practices

These include:

- Promoting organic manures from farmyard animals (thus encouraging livestock production is often important), green leaf manuring and manure from weeds.
- Using and recycling of organic wastes other than farmyard manure (such as other farm crop wastes, forest litter[97] and human sewage) into composts, which can be especially important when the amount of organic manure is insufficient.
- Encouraging production of legumes, crop rotation involving use of legumes (which have the advantage of fixing nitrogen) and inter-cropping with legumes.
- Promoting farming approaches such as mulching, minimum/no tillage farming (conservation agriculture), agroforestry, Push-Pull technology and vermicomposting (involving the use of surface-dwelling earthworms which help to decompose a wide range of organic waste into quality compost.[98])

These programmes should receive public funds in agriculture budgets to encourage their promotion and should form part of the governments' climate adaptation programmes.

- **Promote subsidy programmes supporting ecological farming**. Bio-fertilisers, an alternative to applying chemical inputs, are substances that contain living micro-organisms capable of providing nutrients by fixing nitrogen, which can increase yields while improving soil health and reducing environmental damage from chemical fertilisers.[99] Their production and use by farmers should be subsidised as an alternative to chemical inputs until such time that there is sufficient on-farm production of organic fertilisers. In addition, new bio-pesticides should be developed and greater investments made in Integrated Pest Management, as recommendedby the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD).[100] It is also necessary to move away from promoting monocultures.

Re-orienting institutional policies

Governments also need to refocus their policies on **extension, agricultural research and rural credit** to support ecological farming.

Improving the quality and focus of extension services is vital, since these do not currently support farmers adequately or at all in promoting ecological farming. As well as being under-funded, many extension services are geared to promoting chemical subsidy programmes, using up valuable staff time. Ecological agricultural techniques are best spread from farmer to farmer since they are often specific to an agro-ecological zone, and extension services should facilitate this.[101] Also needed is capacity building through training, farmer field schools, field visits and other initiatives.[102] The successful demonstration of Push-Pull technology in East Africa is largely due to demonstration fields managed by model farmers attracting visits by other farmers during field days, as well as to partnerships with national research systems.[103]

Also critical is **greater investment in agricultural research**. Currently, research is mainly focused on conventional farming and developing 'improved' or hybrid seeds. Research into ecological farming is still in its infancy and tends to receive a minimal allocation in agricultural research budgets.[104] Agricultural research needs to be transformed towards improving the productivity of local seed varieties through better growing practices and soil fertility management, promoting public seed breeding, developing improved ways to use organic fertilisers and composting, and by building on farmers' own knowledge. In addition, research scientists need more training in ecological farming. Moreover, there is need to democratise agricultural research and enable farmer participation in the design and implementation of programmes, and to link national research systems with farmer organisations, civil society and community-based organisations.

Although the need for **agricultural credit** may be reduced by farmers' adopting ecological farming, the need remains for governments to make credit available to encourage long-term investments in farming and/or to purchase (cheap) bio-fertilisers or bio-pesticides. Subsidised credit programmes have often proven successful[105] and are supported by, for example, the UN's High-Level Panel of Experts on Food Security and Nutrition[106], but are largely opposed by donors and some governments.

Other direct support for farmers

There are two further ways governments can directly support farmers promoting ecological farming:

'Eco-bonuses' or payments for environmental services can be made to farmers, whereby governments provide subsidies to farmers who are in effect rewarded for maintaining good soil health on their farms and for providing ecosystem services for the common good. As UNCTAD recommends, 'policy measures are needed that reward farmers for positive externalities such as reducing fossil-fuel based agricultural inputs and implementing other sustainable/green agricultural practices'.[107]

Government procurement policies can also prioritise ecological farming. Brazil's public purchasing programme (*Programa de Acquisiçao de Alimentos*) has famously procured food produced by small-scale farmers for local schools since 2009.[108] African governments could develop similar schemes to buy farmers' produce using ecological farming methods.

Promoting enabling policies

Several other policies are necessary to provide a good context for ecological farming:

Farmers, and farmer organisations, must be viewed by governments as the key actors in their own development and not marginalised in decision-making or seen as actors whose loyalty can be bought through chemical subsidy programmes in rural areas. Putting farmers at the centre of policy – which is key to promoting ecological farming - requires a big shift in political will in many countries.

Farmers must be able to access, breed, use and exchange the *seeds* they need. The promotion of ecological farming will be threatened if control over seeds is exercised by multinational corporations through, for example, intellectual property rights and/or by a government prioritising hybrid or genetically modified seeds.

Farmers must have control over water, land and other natural resources. **Secure land tenure** is important if farmers are to make long-term investments in their farms and the sustainability of the environment. This is currently threatened by land grabs and other arbitrary government policies.

Governments can promote **public awareness** of the costs of chemicals and benefits of ecological farming.

Government must also ensure that **female farmers**, who comprise the majority of small-scale farmers in many countries, are integrally involved in the design and participation of ecological farming strategies and are the intended beneficiaries of policies.

Tax policies in the area of agriculture (for example on imports of chemical or bio-fertilisers) should favour the promotion of ecological farming. Environmental taxes can be levied on the chemical fertiliser industry and use of chemicals.

Governments need to provide **public goods**, such as infrastructure (roads, electricity), market information services (on prices and markets, for example), weather information and ensure farmers can access local and regional markets to sell their produce.

According to the UN Special Rapporteur on the Right to Food:
'Agro-ecological practices require the supply of public goods such as extension services, storage facilities, rural infrastructure (roads, electricity, information and communication technologies) and therefore access to regional and local markets, access to credit and insurance against weather-related risks, agricultural research and development, education, and support to farmer's organisations and cooperatives. While this requires funding, the investment can be significantly more sustainable than the provision of private goods, such as fertilisers or pesticides that farmers can only afford so long as they are subsidised'.[109]

© Greenpeace / Jennifer Heslop. Eggs and damage of the stemborer to maize. ICIPE field station Mbita Point, Suba District, Kenya. 2000.

© Greenpeace / Jennifer Heslop. Self-help project to support Rusinga Island with help from ICIPE field station Mbita Point, Kenya. 2000.

Recommendations to the Malawian and Kenyan governments

The Malawian and Kenyan governments should increase their support to ecological farming, including agroforestry and Push-Pull technology, by increasing budgetary allocations and providing better advice and training to farmers in the extension system. Such support is likely to be more cost-effective for the government, and more profitable for farmers, than subsidising or using chemical fertilisers. Larger investments in ecological farming can be made by reducing, and eventually abolishing, the fertiliser subsidy programmes.

Recommendations to donors

Donors must also drastically step up their support for ecological farming.

They should increase investments in ecological farming and shift existing agricultural finance to scale up such farming, invest in rebuilding extension services to scale up the uptake of ecological farming practices and champion reform of global agricultural research and development to re-focus this on ecological farming. Climate change adaptation plans and financing must also be focused on supporting those most vulnerable to risk – small-scale farmers – to increase their uptake of ecological farming practices to increase resilience.

Many donors remain unconvinced of the benefits of ecological agriculture for poverty alleviation and rural development. We call on them to fund larger studies than we have been able to undertake for this report to assess the profitability for small-scale farmers of ecological farming approaches, and identify how these can be scaled up to reach larger numbers of farmers.

© Greenpeace / Sven Torfinn. Organic Potatoes in Kenya. 2013.

© Greenpeace / Sven Torfinn. Organic Banana Crops in Kenya. 2013.

© Greenpeace / Sven Torfinn. Fields with Maize in Kenya. 2013.

© Greenpeace / Sven Torfinn. Organic Chili Peppers in Kenya. 2013.

Annex 1

Studies of ecological farming projects in East Africa showing evidence of increased incomes to small-scale farmers

Study	Coverage	Comparator/ transition
Agroforestry		
A.Mwalwanda et al, 'Impact of Fertiliser Trees on Maize Production and Food Security in Six Districts of Malawi', 2011, World Agroforestry Centre [110]	Assessed intercropping of maize with fertiliser trees in 6 districts of Malawi (interviewing 240 farmers). Part of the Agroforestry Food Security programme	Study assessed the comparative performance of maize under two production systems: conventional (use of chemical fertilisers and non-use) and intercropping maize with fertiliser trees.
Festus Akinnifesi et al, 'On farm assessment of legume fallows and other soil fertility management options used by smallholder farmers in southern Malawi', *Agricultural Journal*, 2009 [111]	Studied maize agroforestry practiced by 152 farmers in 3 districts of southern Malawi	Compared farmers practising maize agroforestry (using chemicals and no chemicals) with those not.
World Agro-Forestry Centre, *A Rural Revival in Tanzania: How Agro-forestry is helping farmers to restore the woodlands in Shinyanga Region*, 2010 [112] 'Regenerating Woodlands: Tanzania's HASHI Project' [113]	Impact assessment of Tanzania's HASHI project (Shinyanga Soil Conservation Programme), which has rehabilitated large areas of land in the Western provinces of Shinyanga and Tabora using agroforestry. By 2004, 18 years into the project, at least 350,000 hectares of ngitili (the Sukuma term for enclosures) had been restored or created in 833 villages, encompassing a population of 2.8 million.	
'Push-Pull' [114]		
Martin Fischler, Impact assessment of Push-Pull technology developed and promoted by ICIPE and partners in Eastern Africa, *Intercooperation*, 2010 [115]	An impact assessment of Push-Pull technology among 144 food crop farmers in villages of western Kenya and eastern Uganda	Does not say but apparently compares use of Push-Pull with non-use of chemical pesticides.
Zeyaur Khan et al, 'Push-Pull technology: A conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa', International journal of agricultural sustainability, 2011 [116]	Reviews success of Push-Pull in East Africa.	
Fodder shrubs [117]		
F.Place at al, *The impact of fodder trees on milk production and income among smallholder dairy farmers in East Africa and the role of research*, World Agro-forestry Centre, 2009 [118]	Study of impact of fodder shrub adoption for farmers in selected districts of Kenya, especially on animal milk production	Those not using fodder shrubs
Charles Wambugu et al, 'Research, development and scaling up the adoption of fodder shrub innovations in East Africa, 2011, International journal of agricultural sustainability [119]	Reviews success of fodder shrubs in East Africa	
World Agro-forestry Centre, *Fodder for a Better Future: How agro-forestry is helping to transform the lives of small-scale dairy farmers in East Africa*, 2010 http://worldagroforestry.org/our_products/publications/details?node=53081	Reviews success of fodder shrubs in East Africa	
Certified organic export		
4 studies cover the same project: (a) Peter Gibbon et al, *Certified Organic Export Production: Implications for economic welfare and gender equality among smallholder farmers in tropical Africa*, UNCTAD, 2008 [120] (b) Peter Gibbon / Simon Bolwig, *The Economics of Certified Organic Farming in Tropical Africa: A preliminary assessment*, 2007 [121] (c) *Simon Bolwig / Moses Odeke*, Household Food Security Effects of Certified Organic Export Production in Tropical Africa, *May 2007* [122] (d) Peter Gibbon et al, *Revenue Effects of Participation in Small-scale Organic Cocoa Production in Tropical Africa: A Case Study, 2009* [123]	Based on research during 2005-06 in Uganda among small-scale farmers of certified organic coffee, cocoa and vanilla, and pineapple. Farmers were contract farmers in schemes organised by exporting firms.	Compared to conventional farmers of those crops. (Source doesn't specify conventional but it seems to mean non-certified and 'organic by default'. Most conventional farmers use few/no chemical fertiliser)
Rune Jacobsen, *Organic Agriculture in Uganda*, Roskilde University, Denmark, 2009 [124]	Research in 2009 in Uganda among farmers growing a mix of food and cash crops (including cotton) who had switched from conventional to certified organic farming	Compared to conventional farmers of those crops.
Conservation agriculture		
M.Owenya et al, 'Conservation agriculture (CA) in Tanzania: the case of the Mwangaza B CA farmer field school (FFS), Rhotia Village, Karatu District, Arusha', *2011*, International journal of agricultural sustainability [125]	Study of impact of adoption of conservation agriculture by food crop (maize, beans, wheat, barley etc) farmers in six districts in Tanzania involving 3,500 farmers (p.147). Project ran from 2004-10.	Does not say (assumption is non-chemical users)
General		
Mica Bennett and Steven Franzel, 'Can organic and resource-conserving agriculture improve livelihoods? A synthesis, International journal of agricultural sustainability, 2013 [126]	Examines 31 documented cases of African and Latin American farmers converting from conventional or organic-by-default systems to 'organic and resource-conserving agriculture'. (ORCA) Of the 31 cases, 11 are in East Africa. Note that all of these except one (which is from 1998 are considered in this table above)	

	Results
	Use of fertiliser trees enhanced maize grain yields over those not using them. Maize grain yields from plots intercropped with fertiliser trees were more than twice those solely cropped with maize without fertilisers. Overall fertiliser trees obtained 1.4 times more maize grain than non-users, translating into greater food security. (p.2) 'The yield difference between maize with fertiliser trees and maize with both fertiliser trees and mineral fertiliser was negligible indicating fertiliser trees had stronger influence over mineral fertilisers in contributing to maize yield. Maize grain yield from plots with fertiliser trees had 1.8 times more yield than maize from plots that only received minimal fertiliser', (p.13) Study says incomes rose but gives no details (p.28)
	Agroforestry increased maize yields by 54-76% compared to unfertilised sole maize. When chemical fertiliser was also used, yield increase was 73-76% across tree species. 'Compared to the control (ie, unfertilised sole maize) agroforestry practices increased maize yields by 62-80% without fertiliser amendment. When amended with fertiliser, the yield increase over the control was 81-87%' (p.266)
	One 2004 study calculated the total monthly value of benefits derived from the rehabilitated fodder reserves (ngitili, which provide fuelwood and building timber as well as livestock fodder) to be $14 per person
	75% of the assessed farmers said they achieved maize yield increases of 3-4-fold. Farmers have achieved increased incomes by selling surplus grains, milk and fodder. (p.2) 33% of villages where farmers were interviewed cited increased incomes. (p.10) Nationally, the economic benefits are estimated at $2-3 million a year (for 25,000 farmers using Push-Pull) compared with traditional maize-bean intercropping or maize monocultures; this is an average of around $100 per family. (p.13)
	Push-Pull 'increases maize yields from below 1 to 3.5 tonnes/ha and is economical as it is based on locally available plants not expensive external inputs' (p.162). Has resulted in 'significant improvements in economic returns to the farmers' (p.164) Increased income results from the sale of grain surpluses, fodder and milk and desmodium seeds. 'The losers are the chemical companies… that provide seasonal inputs that are largely not sustainable'. (p.167) Maize grain yields have increased 3-4-fold and sorghum yields 2-fold. 'This has enabled a typical family of six to move from a situation of food insecurity to food sufficiency'. (p.165)
	Fodder shrub cultivation has increased milk production and provided additional net income from milk worth $19.7 – 29.6 million over the last 15 years in Kenya. This is an average per household of $29-44 (pp.iv, 34)
	Fodder shrubs contribute $3.8 million a year to farmers' incomes (and have potential income of $81 million). (p.100) Results in cow milk yield increases of 0.6-1.4 litres a day. From milk sales, farmers receive an extra $35 net annual income. (p.105)
	Research in Kenya and Uganda in 2002/03 found that farmers with one cow and 500 fodder trees (which cost less than $8 to establish) who use calliandra (one type of fodder tree) as a substitute for dairy meal increase annual incomes by $101-122. (pp.13, v)
	'Farms that engage in certified organic export production are significantly more profitable in terms of farm income earnings than those that engage only in conventional production' (a, p.2) 'Conversion to organic export production… improved [food security] by augmenting cash incomes' (a, p.2). 'Scheme participation is associated with increases in household net cocoa revenue and in household net cocoa and vanilla revenue taken jointly of around 150 per cent on average' (d, p.22) Higher incomes resulted mainly from price premiums for organic exports and also higher volumes due to increased yields. (a, p.4) Improved incomes did not mainly result from lower expenses on chemical inputs since most conventional farmers used little anyway (a, p.5)
	Increased incomes were reported by 95 per cent of farmers interviewed. Extra incomes were $41-61 per acre per season. Higher revenues came mainly from access to a guaranteed market and ability to sell larger volumes of produce. (Source does not specify yield increases) (p.41)
	'The yields under CA are generally higher and farmers noted that intercropping of maize with cover crops… provided three harvests instead of two… Yields under CA increased from 1.25 tonnes/ha (2004) to 7 tonnes/ha (2009)'. (p.149) Some farmers have stopped using herbicide and chemical fertilisers. (p.148)
	Net income improved in 19 of 23 cases that reported changes. Yield improved in 16/25 and food security in 7/8. Of the 11 in East Africa, net income improved in 7 while this was not reported in the other 4. (p.199, Appendix). Note that these income increases were driven by price premiums received by being certified organic in all 19 cases (p.201)

Annex 2

Malawi's spending on chemicals versus spending on ecological farming

Spending on/promotion of chemicals	Promotion of ecological farming
Calls for continuation of the FISP to reach 1.6 million farmers every year (and for 'improved efficiency' of input use) One component of the strategy – called 'Maize self-sufficiency' - gives a FISP budget for the 4 years 2010/11 to 2013/14 of **$155 million a year or $620 million in total**, which amounts to 35% of the agriculture budget. Also promotes fertiliser subsidy for tobacco, input subsidy for legume seeds and calls for 'consideration' of input subsidy for 'cotton seeds and chemicals'.	One 'Focus area' of the strategy (called 'Sustainable land and water management') has two 'components' related to promoting ecological farming: 'sustainable agricultural land management' (SALM) and 'sustainable agricultural water management' (SAWM). The total budget for both areas for the four years is **$641 million**. However, of this, **$57 million is for SALM** (which includes promoting conservation farming and agroforestry) and **$584 million is for SAWM** (the huge majority of which - $560 million - is to 'develop new irrigation schemes with appropriate systems'). 47,526 ha of land are currently under **conservation farming**[127] and aims to increase this with a budget of **$19.5 million** over the 4 years. 49,858 ha of land are under agroforestry and aims to increase this with a budget of $35 million over the 4 years. The promotion of SALM includes promoting the use of 'organic technologies' and organic farming is seen as one of the 'exit strategies' of the FISP. The documents calls for promoting **Integrated Pest Management** but this does not appear specifically in the budget. There is no mention of **Push-Pull** approaches.

© Greenpeace / Sven Torfinn Small-scale farmer James Njoronge inspecting his crops. In Kenya and many parts of East Africa, Collard Greens are more commonly known by their Swahili name, Sukuma Wiki. 2013.

References

[1] International Assessment of Agricultural Knowledge, Science and Technology for Development, Global Report, 2009, p560.

[2] http://www.ifoam.org/en/organic-landmarks/definition-organic-agriculture

[3] Global Partnership on Nutrient Management, Our Nutrient World: The challenge to produce more food and energy with less pollution, 2013, p.ix

[4] Thomas Jayne and Shahidur Rashid, 'Recent evidence from input subsidy programmes in Africa: Highlights from a special issue of Agricultural Economics', IFPRI, November 2013, p.2. Another estimate is that in 2012, around $2 billion was spent by just seven African countries (including Kenya, Tanzania and Malawi, the others being Nigeria, Ethiopia, Zambia, and Ghana) on such programmes. (Jacob Ricker-Gilbert et al, 'Addressing the "Wicked Problem" of Input Subsidy Programs in Africa', Applied Economic Perspectives and Policy, 2013, http://aepp.oxfordjournals.org/content/early/2013/02/12/aepp.Push- Pull001.full). But this figure seems far too high.

[5] UNEP, 'Urgent Action Needed to Reduce Growing Health and Environmental Hazards from Chemicals: UN Report', 5 September 2012, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=2694&Arti cleID=9266

[6] J. Guo, et al, 'Significant Acidification in Major Chinese Croplands', Science, 2010, 327: 1008-1010.

[7] Jules Pretty, 'Agro-ecological Approaches to Agricultural Development', Background Paper for the World Development Report 2008, 2008, p.6

[8] Jessica Bellarby et al, Cool Farming: Climate Impacts of Agriculture and Mitigation Potential, Greenpeace, 2008, p.6

[9] In 2005, nitrous oxide emissions from soils (most of which derives from fertiliser use) produced around 2,128 MT of CO2 eq and fertiliser production caused emissions of around 410 MT of CO2 eq. Together, these amount to around 5 per cent of greenhouse gas emissions. Jessica Bellarby et al, Cool Farming: Climate Impacts of Agriculture and Mitigation Potential, Greenpeace, 2008, pp.7-8

[10] See, for example, K.Mondelaers et al, A meta-analysis of the differences in environmental impacts between organic and conventional farming. British Food Journal 111 (10), 2009, https://biblio.ugent.be/input/download?func=downloa dFile&recordOId=682772&fil eOId=901101; P. Tittonell, 'Livelihood strategies, resilience and transformability in African agroecosystems', Agricultural Systems, in press, 2014; P.Tittonell & K. Giller, 'When yield gaps are poverty traps: The paradigm of ecological intensification in African smallholder agriculture', Field Crops Research, 143: 76-90, 2013; UNEP/ UNCTAD, Organic Agriculture and Food Security in Africa, 2008, http://www.unctad.org/en/docs/ditcted200715_en.pdf.

[11] World Bank data, http://data.worldbank.org/country/Malawi

[12] This is based on 1.5 million farmers with an average 1.5 acres devoted to maize, multiplied by $93 per acre.

[13] 'Agroforestry: agricultural policy of the future', 24 February 2014, www.farming.co.uk

[14] Rose Mwangi, NAAIAP Secretariat, NAAIAP Commercializing Smallholder Maize Production, June 2012, www.fao.org. Other sources give a figure of KES 2.7 billion in 2013 ; Business Daily, 21 March 2013, http://www.businessdailyafrica.com/Govt- sets-aside-Sh2-7b-to-import-fertiliser/-/539546/1726818/-/11io0gw/-/index.html

[15] http://www.kilimo.go.ke/index.php?option=com_content&view=article&id=676:speech-by-mr-felix-k-koskei-during-the-official-opening-of-the-2013-nairobi-international-trade-fair-wednesday-2nd-october-2013&catid=48:press-releases&Itemid=50 Business Daily, 27 November 2012, http://www.businessdailyafrica.com/Corporate-News/State-seeks-strategic- investor-for-Sh38bn-fertiliser-plant-/-/539550/1630518/-/rt3rwgz/-/index.html

[16] Government of Malawi, 2013/14 Financial Statement, p.21, http://www.finance.gov.mw/index.php?option=com_docman&Itemid=107

[17] '2014 African Green Revolution Forum', http://agra-alliance.org/media- centre/news/2104-african-green-revolution- forum/?keywords=green+revolution#.U-jOG0h9k58

[18] Global Partnership on Nutrient Management, Our Nutrient World: The challenge to produce more food and energy with less pollution, 2013, p.ix

[19] Wesley Stephenson, 'Indian farmers and suicides: How big is the problem?', 23 January 2013, http://www.bbc.co.uk/news/magazine-21077458 P.Sainath, 'The largest wave of suicides in history', February 2009, www.zcommunications.org

[20] Gitonga Njeru, 'Climate-related farmer suicides surging in eastern Kenya', 12 July 2010, http://www.trust.org/item/20100712130100-yitv5/

[21] Thomas Jayne and Shahidur Rashid, 'Recent evidence from input subsidy programmes in Africa: Highlights from a special issue of Agricultural Economics', IFPRI, November 2013, p.2. Another estimate is that in 2012, around $2 billion was spent by just seven African countries (including Kenya, Tanzania and Malawi, the others being Nigeria, Ethiopia, Zambia, and Ghana) on such programmes. (Jacob Ricker-Gilbert et al, 'Addressing the "Wicked Problem" of Input Subsidy Programs in Africa', Applied Economic Perspectives and Policy, 2013, http://aepp.oxfordjournals.org/content/early/2013/02/12/aepp.Push- Pull001.full). But this figure seems far too high.

[22] The 11 are: Burkina Faso, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania, Togo and Zambia. The six are: Chad, Lesotho, Mauritania, Mozambique, Sierra Leone and Zimbabwe. FAO, Food and Agriculture Policy Decisions: Trends, emerging issues and policy alignments since the 2007/08 food security crisis, 2014, p.13, www.fao.org/docrep/019/i3514e/i3514e.pdf

[23] Figures from FAOStat, http://faostat3.fao.org/faostat-gateway/go/to/home/E accessed 1 August 2014

[24] WHO, Childhood Pesticide Poisoning: Information for advocacy and action, May 2004, p.7

[25] UNEP, 'Urgent Action Needed to Reduce Growing Health and Environmental Hazards from Chemicals: UN Report', 5 September 2012, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=2694&Arti cleID=9266

[26] Jules Pretty, 'Agro-ecological Approaches to Agricultural Development', Background Paper for the World Development Report 2008, 2008, p.6

[27] Greenpeace, 'The Real Cost of Nitrogen Fertiliser', August 2010, www.greenpeace.org

[28] United Nations Economic and Social Commission for Asia and the Pacific, Sustainable Agriculture and Food Security in Asia and the Pacific, 2009, p.10

[29] In 2005, nitrous oxide emissions from soils (most of which derives from fertiliser use) produced around 2,128 MT of CO2 eq and fertiliser production caused emissions of around 410 MT of CO2 eq. Together, these amount to around 5 per cent of greenhouse gas emissions. Jessica Bellarby et al, Cool Farming: Climate Impacts of Agriculture and Mitigation Potential, Greenpeace, 2008, pp.7-8

[30] Nadi El-Hage Scialabba and Maria Muller-Lindenhauf, 'Organic agriculture and climate change', Renewable Agriculture and Food Systems, March 2010, p.159; UNEP, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, 2011, p.61

[31] Greenpeace's definition is at: http://www.greenpeace.org/international/Global/international/publications/agriculture/2011/Defining-Ecological-Farming-2009.pdf

[32] Jules Pretty, 'Agroecological Approaches to Agricultural Development', Background Paper for the World Development Report 2008, 2008, p.3. A 2007 study by the University of Michigan, comparing a global dataset of 293 examples of yields of organic versus conventional or low-intensive food production, concluded that organic farming methods could produce enough food to feed the world population on a per capita basis; it also found that leguminous cover crops could fix enough nitrogen to replace the amount of synthetic fertiliser currently in use. The study also noted – critically – that yield increases from organic farming methods would be even greater if more agricultural research were focused on sustainable agriculture. Catherine Badgely et al, Organic Agriculture and the Global Food Supply', Renewable Agriculture and Food Systems, 22(2), 2007

[33] For example, research commissioned by the UK government reviewed 40 sustainable agriculture projects in Africa during the 2000s – involving practices such as agro-forestry, soil conservation and integrated pest management – and showed that yields more than doubled over 3-10 years; see Jules Pretty et al, 'Sustainable Intensification in African Agriculture', International Journal of Agricultural Sustainability, February 2011. See also Catherine Badgely et al, Organic Agriculture and the Global Food Supply', Renewable Agriculture and Food Systems, 22(2), 2007

[34] Jules Pretty, 'Agroecological Approaches to Agricultural Development', Background Paper for the World Development Report 2008, 2008, p.19

[35] FAO, International Conference on Organic Agriculture and Food Security, May 2007, p.12; Sununtar Setboonsarng, 'Organic Agriculture, Poverty Reduction and the Millennium Development Goals', ADB Institute Discussion Paper No.54, August 2006, p.8; FAO, International Conference on Organic Agriculture and Food Security, May 2007, p.8

[36] Ministry of Agriculture, Strategic Plan 2008-2012, para 1.1

[37] Patrick Alila and Rosemary Atieno, 'Agricultural Policy in Kenya: Issues and Processes: Paper for the Future Agricultures Consortium', IDS/University of Nairobi, July 2006, pp.4, 12

[38] Government of Kenya, Medium-Term Investment Plan, 2010-2015, undated, p.14

[39] Government of Kenya, Central Bureau of Statistics-Geographical Dimensions of Well Being, Volume II, 2005; IFAD, 'Rural poverty in Kenya', http://www.ruralpovertyportal.org/web/guest/country/home/tags/kenya

[40] Rose Mwangi, NAAIAP Secretariat, NAAIAP Commercializing Smallholder Maize Production, June 2012, www.fao.org

[41] The Nation, 21 October 2013: http://www.nation.co.ke/counties/Ministry-orders-fertiliser-for-next-season/-/1107872/2040286/-/j9qwo3z/-/index.html

[42] Rose Mwangi, NAAIAP Secretariat, NAAIAP Commercializing Smallholder Maize Production, June 2012, www.fao.org. Other sources give a figure of KES 2.7 billion in 2013 ; Business Daily, 21 March 2013, http://www.businessdailyafrica.com/Govt- sets-aside-Sh2-7b-to-import-fertiliser/-/539546/1726818/-/11io0gw/-/index.html

[43] Nicholas Waitathu, 'State ups agriculture budget by Sh15bn to boost food security', 5 May 2014, http://www.standardmedia.co.ke/business/article/2000111025/state- ups-agriculture-budget-by-sh15bn-to-boost-food-security

[44] 'Speech by Mr Felix Koskei during the official opening of the 2013 Nairobi international trade fair', 2 October 2013, http://www.kilimo.go.ke/index.php?option=com_content&view=article&id=676:speech-by-mr-felix-k-koskei-during-the-official-opening-of-the-2013-nairobi-international-trade-fair-wednesday-2nd-october-2013&catid=48:press-releases&Itemid=50

[45] Business Daily, 27 November 2012, http://www.businessdailyafrica.com/Corporate-News/State-seeks-strategic-investor-for-Sh38bn-fertiliser-plant-/-/539550/1630518/-/rt3rwgz/-/index.html; 'Japanese firm to construct fertiliser plant in Kenya', 25 February 2014, http://www.capitalfm.co.ke/business/2014/02/japanese-firm-to-construct- fertiliser-plant-in-kenya/

[46] Speech by Mr Felix Koskei during the official opening of the 2013 Nairobi international trade fair', 2 October 2013, http://www.kilimo.go.ke/index.php?option=com_content&view=article&id=676:speech-by-mr-felix-k-koskei-during-the-official-opening-of-the-2013-nairobi-international-trade-fair-wednesday-2nd-october-2013&catid=48:press-releases&Itemid=50

[47] Republic of Kenya, Agriculture Sector Development Strategy, 2010-20, 2010, pp.21, 34

[48] http://www.Push-Pull.net/

[49] http://www.Push-Pull.net/; http://www.Push-Pull.net/extension.shtml

[50] Gravid stemborer females are repelled or deterred away from the target crop (push) by stimuli that mask host apparency while they are simultaneously attracted (pull) to the trap crop, leaving the target crop protected. http://www.Push- Pull.net/3.shtml

[51] See 'Push-Pull' on ICIPE website: http://www.Push-Pull.net/3.shtml accessed 1 August 2014

[52] See 'Push-Pull' on ICIPE website: http://www.Push-Pull.net/3.shtml accessed 1 August 2014

[53] Charles Wambugu et al, 'Research, development and scaling up the adoption of fodder shrub innovations in East Africa, 2011, International journal of agricultural sustainability, http://www.tandfonline.com/doi/abs/10.3763/ijas.2010.0562#.UlQliBCZ6rY

[54] Exchange rate used: KShs 87/USD for August 2014.

[55] Unicef statistics, http://www.unicef.org/infobycountry/kenya_statistics.html

[56] Unicef statistics, http://www.unicef.org/infobycountry/kenya_statistics.html

[57] Only one farmer spends money on pesticides – KES 1,000

[58] Republic of Malawi, Agriculture Sector Wide Approach: Malawi's prioritised and harmonised agricultural development agenda, September 2010, p.9, www.caadp.net/pdf/Investment%20plan%20-%20Malawi.pdf

[59] http://data.worldbank.org/country/malawi

[60] FAO, The State of Food and Agriculture 2012: Investing in Agriculture, p.26. The others are Ethiopia, Niger, Mali, Burkina Faso, Senegal and Guinea.

[61] In 2012/13, the FISP purchased 150,000 tonnes of fertilisers for distribution to 1.5 million farm families at a subsidised price of MK 500 ($1.2) per 50 kg bag; Budget Statement 2012/13,p.35, http://www.finance.gov.mw/index.php?option=com_docman&task=cat_view&gid=75 &Itemid=114; Budget Statement 2013/14, p.15 http://www.finance.gov.mw/index.php?option=com_docman&task=cat_view&gid=85 &Itemid=114

[62] Government of Malawi, 2013/14 Financial Statement, p.21, http://www.finance.gov.mw/index.php?option=com_docman&Itemid=107

[63] The seed subsidy is additional to the fertiliser subsidy and amounted to MK 7.6 billion in 2012/13 and MK 5.5 billion in 2013/14. Thus in the 2013/14 Budget Statement, the government refers to a MK60.1 billion allocation to the FISP. Budget Statement 2013/14, p.15, http://www.finance.gov.mw/index.php?option=com_docman&task=cat_view&gid=85 &Itemid=114

[64] For further analysis of the costs of the FISP, see Ephraim Chirwa and Andrew Dorward, Agricultural Input Subsidies: The recent Malawi experience, OUP, 2013, p.120

[65] Ephraim Chirwa and Andrew Dorward, Agricultural Input Subsidies: The recent Malawi experience, OUP, 2013, p.123

[66] www.caadp.net/pdf/Investment%20plan%20-%20Malawi.pdf

[67] Dennis Garrity, 'Evergreen Agriculture: a robust approach to sustainable food security in Africa', http://evergreenagriculture.net/content/evergreen-agriculture- robust-approach-sustainable-food-security-africa

[68] 'Agro-forestry and our role', http://www.worldagroforestry.org/about_us/our_role_in_agroforestry accessed 1 August 2014

[69] 'Agro-forestry and our role', http://www.worldagroforestry.org/about_us/our_role_in_agroforestry accessed 1 August 2014

[70] Exchange rate used: MK393/USD for August 2014.

[71] This is not the same as income. The value of production is the worth of maize produced if sold (which it often is not).

[72] World Bank data, http://data.worldbank.org/country/Malawi accessed 1 August 2014

[73] This is based on 1.5 million farmers with an average 1.5 acres devoted to maize, multiplied by $93 per acre.

[74] This is not the same as income. The value of production is the worth of maize produced if sold (which it often is not).

[75] This is actual income from sales, as stated by the farmer, and covers all crops not just maize

[76] 'An optimal solution that could be an exit strategy from fertiliser subsidy schemes would be to link fertiliser subsidies directly to agroforestry investments on the farm in order to provide for long-term sustainability in nutrient supply, and to build up soil health as the basis for sustained yields and improved efficiency of fertiliser response.' UN General Assembly, Human Rights Council, Report submitted by the Special Rapporteur on the right to food, Olivier De Schutter, 20 December 2010, para 20

[77] UNEP, The Environmental Food Crisis: The Environment's Role in Averting Future Food Crises, 2009

[78] The FAO has strongly called for the adoption of sustainable agriculture. (See FAO, International Conference on Organic Agriculture and Food Security, May 2007). IFAD, however, notes that sustainable agriculture techniques do not represent 'stark alternatives to conventional approaches' based on improved seeds and agro- chemicals but that sustainable agriculture approaches can be promoted within a broader agenda to adapt to local circumstances (See IFAD, Rural Poverty Report 2011, 2011, p.159)

[79] UNCTAD, Trade and Environment Review 2013: Wake up before it's too late, 2013

[80] IFAD, Rural Poverty Report 2011, 2011, especially chapter 5

[81] 'Agro-ecology and the Right to Food, Report presented at the 16th Session of the United Nations Human Rights Council, March 2011, A/HRC/16/49, http://www.srfood.org/en/official-reports

[82] See the collection of IAASTD reports at: http://www.unep.org/dewa/assessments/ecosystems/iaastd/tabid/105853/default. aspx

[83] Report submitted by the Special Rapporteur on the right to food, Olivier de Schuetter, UN General Assembly, Human Rights Council, 20 December 2010, para 34; Ben McKay, 'A socially inclusive pathway to food security: The agro-ecological alternative', Policy Research Brief, International Centre for Inclusive Growth, June 2012, pp.2-3

[84] IFAD, Rural Poverty Report 2011, p.164; Ben McKay, 'A socially inclusive pathway to food security: The agro-ecological alternative', Policy Research Brief, International Centre for Inclusive Growth, June 2012, pp.3-4

[85] IFAD, Rural Poverty Report 2011, p.164

[86] 'Agroforestry: agricultural policy of the future', 24 February 2014, www.farming.co.uk

[87] World Bank, Basic Agricultural Public Expenditure Diagnostic Review, Final Draft, April 2013, p.xii

[88] For further analysis see ActionAid, Walking the Talk: Why and how African governments should transform their agriculture spending, December 2013, p.59

[89] P.Simasiku et al, 'Natural Resource Management, Food Security and Rural Development in Zambia: Moving from Research to Action', Food Security Research Project, February 2010, p.5

[90] ActionAid, Walking the Talk: Why and how African governments should transform their agriculture spending, December 2013, chapter 7

[91] Budget Speech, 12 October 2012, p.10, www.mofnp.gov.zm

[92] MAAIF, Development Strategy and Investment Plan 2010/11-2014/15, March 2010

[93] 'Lusaka Declaration at African Organic Conference', http://www.organic- market.info/web/News_in_brief/Fairs_+_Conferences/Lusaka/176/186/0/12654.html

[94] Peter Hazell, 'The Asian Green Revolution', IFPRI Discussion Paper, November 2009, p.22

[95] UN Commission on Asia and the Pacific, Sustainable Agriculture and Food security in Asia and the Pacific, 2009, p.103

[96] See, for example, ActionAid, Walking the Talk: Why and how African governments should transform their agriculture spending, December 2013, p.33

[97] Greenpeace India, Subsidising Food Crisis: Synthetic fertilisers lead to poor soil and less food, undated, p.24

[98] Greenpeace India suggests that the government should shift 40 per cent of the costs of the chemical subsidy programme to invest in vermicomposting units to enable to shift to organic nitrogen fertilisation. Greenpeace India, Subsidising Food Crisis: Synthetic fertilisers lead to poor soil and less food, undated, p.2

[99] Greenpeace India, Subsidising Food Crisis: Synthetic fertilisers lead to poor soil and less food, undated, p.22

[100] IAASTD, Global Report, 2009, pp.538, 540, www.agassessment.org

[101] Report submitted by the Special Rapporteur on the right to food, Olivier de Schuetter, UN General Assembly, Human Rights Council, 20 December 2010, para 36. In Latin America, a key factor in the expansion of ecological farming is the Campesino a Campesino (farmer to farmer) movement which strengthens local research and problem-solving by

exchanging ideas and innovations among farmers. Miguel Altieri and C.Nicholls, 'Agro-ecology scaling up for food sovereignty and resiliency', in E.Lichtfouse (ed), Sustainable Agriculture Reviews, 2012

[102] IFAD, Rural Poverty Report 2011, p.176

[103] Report submitted by the Special Rapporteur on the right to food, Olivier de Schuetter, UN General Assembly, Human Rights Council, 20 December 2010, para 33

[104] UNCTAD, Trade and Environment Review 2013: Wake up before it's too late, 2013, p.54

[105] Ha-Joon Chang, Rethinking Public Policy in Agriculture: Lessons from Distant and Recent History, FAO, 2009, pp.30-1, 42

[106] 'The state and the financial institutions (banks, but also pension funds and insurance companies) should study the possibility that the latter dedicate a well- defined part of their lending capacity to smallholders.' UN, High-Level Panel of Experts on Food Security and Nutrition, Investing in Smallholder Agriculture for Food Security, June 2013, p.12

[107] UNCTAD, Trade and Environment Review 2013: Wake up before it's too late, 2013, p.179

[108] The Brazilian government website page on the programme is at: http://www.mds.gov.br/segurancaalimentar/decom/paa

[109] UN Special Rapporteur on the Right to Food, Agroecology and the Right to Food, December 2010, para 37

[110] http://www.worldagroforestrycentre.org

[111] http://www.medwelljournals.com/abstract/?doi=aj.2009.260.271

[112] www.worldagroforestry.org/downloads/publications/PDFs/B16751.PDF

[113] http://www.wri.org/publication/content/8108

[114] See below for explanation

[115] www.Push-Pull.net/Impact_assesment.pdf

[116] http://www.tandfonline.com/doi/abs/10.3763/ijas.2010.0558#.UlLEQhDCZjs

[117] See below for explanation

[118] http://worldagroforestry.org/our_products/publications/details?node=52939

[119] http://www.tandfonline.com/doi/abs/10.3763/ijas.2010.0562#.UlQliBCZ6rY

[120] unctad.org/en/Docs/ditcted20077_en.pdf

[121] subweb.diis.dk/sw32913.asp

[122] https://www.zotero.org/groups/gender_and_climate_change/items/itemKey/HE6JK PCG

[123] www.econstor.eu/bitstream/10419/44663/1/599617365.pdf

[124] www.ddrn.dk/filer/forum/File/Rune_Jacobsen.pdf

[125] www.tandfonline.com/doi/pdf/10.3763/ijas.2010.0557

[126] http://www.tandfonline.com/doi/abs/10.1080/14735903.2012.724925#.UmKTAhD ZhU0

[127] Conservation farming is described in the report as 'technologies that build soil fertility, prevent soil erosion and conserve rain water (contour ridging, application of manure, preparation of compost, minimum tillage, agro-forestry, box ridges, tractor ploughing to break the hard hoe pan, and use of herbicides as a labour saving technology', p.62

© Greenpeace / Matthias Ziegler. Field worker with a friend between two fields in Kenya. It is their task to drive away the birds with their catapult. 2001.

GREENPEACE

RSA Office:
10A and 10B Clamart House, Clamart Road, Richmond, Johannesburg, South Africa

Postal address:
Greenpeace Africa, PostNet Suite 125, Private Bag X09 Melville, Johannesburg, 2109, South Africa

DRC Office:
Greenpeace Environnemental Organisation N°11, avenue Kauka/Quartier le Royal Commune de la Gombe, Kinshasa/RDC

Senegal Office:
2, Avenue Hassan II, 6eme etage, Dakar, Senegal

iafrica@greenpeace.org
www.greenpeaceafrica.org

Greenpeace exists because this fragile Earth deserves a voice. It needs solutions. It needs change. It needs action!

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behavior, to protect and conserve the environment and to promote peace. It comprises of 28 independent national/regional offices in over 40 countries across Europe, the Americas, Asia, the Pacific and Africa as well as a co-coordinating body, Greenpeace International.

Greenpeace has been working in Africa to end environmental destruction and fighting for the right of Africans to a healthy environment since the early 1990s. Our campaigns focus on climate change, halting the destruction of tropical forests, supporting ecological farming and preventing the degradation of marine ecosystems.