


Climate Resilient Sustainable Agriculture:
A Real Alternative to False Solutions

A Backgrounder
June 2012

actionaid

Acknowledgements

This backgrounder was written by Youjin B. Chung and Christina Billingsley with inputs from Ruchi Tripathi, Celso Marcatto, Aftab Alam Khan, and Harjeet Singh. Section 4 is largely drawn from ActionAid International. 2011. *Fiddling with Soil Carbon Markets While Africa Burns*, and Section 5 is based on an internal ActionAid Toolkit on Climate Resilient Sustainable Agriculture.

Cover photos: [L] A rural worker hand-harvests sugarcane for ethanol and sugar production in Goiás State, Brazil – a region where monoculture sugarcane has been produced for several decades. Brazil is the world's second-largest ethanol producer, and sugarcane is the primary feedstock. Besides the destruction of native vegetation, the monoculture sugarcane industry has replaced areas of food production and cattle-raising in several States of Brazil, expanding the agricultural borders through the Amazon. It has also displaced small farmers from their land, increased unemployment, worsened food insecurity, caused health problems for the rural workers, depleted the soil, and contaminated water sources.© Celso Marcatto. [R] Walmir de Miranda is an agroecological farmer of the Queimadas Rural Workers´ Union in Paraíba State, Brazil. He and his fellow farmers practice multi-cropping and integrated crop-livestock farming, growing corn, beans, cassava, vegetables, and many different types of fruits. He uses the cactus to feed his animals, such as cows and goats. Since water is one of the main challenges in the semi-arid region of Paraíba State, he has constructed an underground dam, stone tanks, and a cistern to collect rainwater. © Celso Marcatto.

Contents

1. Introduction

In recent times, climate change has received the highest level of political and media attention, however little has been achieved to arrest the increasing carbon emissions that are responsible for global warming. Agriculture, along with land use change, enjoys double distinction of being both a driver and a victim of climate change. On one hand, the carbon emissions related to each stage of the agricultural value chain – from seed to plate – contribute to climate change, while on the other hand, the negative impacts of climate change (e.g. growing frequency and intensity of rainfall, higher temperatures, shorter growing seasons, changing patterns of pests and diseases) may lead to crop damage, land degradation, and food insecurity.[1]

ActionAid's field work confirms that climate change-induced declines in crop production are already happening today and affecting the food security of rural smallholder farmers.[2] In fact, the Intergovernmental Panel on Climate Change (IPCC) estimates that in some countries in Africa, yields from rain-fed agriculture could be reduced by up to 50 per cent by 2020[3], and in Central and South Asia, crop yields could fall by up to 30 per cent by 2050[4] as a result of climate change. India alone could lose 18 per cent of its rain-fed cereal production.[5] In other words, too much or too little rainfall spells disaster for as much as 70 per cent of the world's extreme poor who depend on rain-fed agriculture for their livelihoods.[6]

In the face of this imminent threat, smallholder farmers have begun to respond to failing crops and increased hunger by adopting low-input agroecological farming techniques that help improve their food security and diversify their livelihoods.[7] **ActionAid believes that agroecology-based Climate Resilient Sustainable Agriculture (CSRA) is an effective way to respond to both the climate and food crisis**. CRSA proposes to overcome the gaps of contemporary mitigation and adaptation programmes in agriculture by bringing to the fore the actual priorities, needs, and knowledge of farming communities themselves. CRSA prioritises the right to food, environmental conservation, and long-term community resilience in order to reduce food insecurity at the local level, and contribute to effective national and international climate change policies that support self-sufficiency and sustainability in agricultural systems worldwide.

However, rich countries and multilateral agencies are turning a blind eye to the potential of agroecology as a long-term strategy to tackling climate change. Instead, they are promoting "false solutions"– in the form of biofuels, carbon markets, and soil carbon sequestration which comes packaged with "Climate-Smart Agriculture" – to shift their responsibility and mitigation burden onto poor countries and communities. Such solutions are irrelevant, if not harmful, to the very groups they aim to serve. Instead of meeting their obligations to provide adequate, predictable, additional and reliable public finance to developing countries to reduce emissions, protect forests, and adapt to climatic shocks, rich countries are diverting their time, effort and money to create new markets for private sector interests.[8]

In short, this document will illustrate the relationship between climate change and agriculture; review and demonstrate how current climate change policy responses fall short of addressing the realities of poor rural farmers who are the most vulnerable to the impacts of climate change; and paint an alternative way forward by defining CRSA and suggesting recommendations to national governments.

2. Linkage between Climate Change and Agriculture

The relationship between climate change and agriculture is complex both ecologically and politically. Climate variability is inherently linked to the productive capacity of agricultural production systems worldwide. Although many traditional farming communities have been able to cope with climatic extremes throughout history, it is the pace of human-induced climate change and the increasing unpredictability of climatic conditions that seriously constrain their adaptive capacity, especially for the resource-poor farmers. Sudden shocks and extreme weather conditions, such as cyclones, floods, and droughts, are projected to increase in intensity and/or frequency and location with climate change – a trend that has been observed in recent decades.[9] Compromised access to water, basic infrastructures, and other agricultural inputs exacerbate tenuous livelihood strategies of the rural poor, the majority of whom depend directly or indirectly on agriculture.[10] Hence, without appropriate response mechanisms, climate change could severely impede the ability of developing countries to feed themselves.

In fact, **climate change is expected to have a far-reaching impact on crop productivity particularly in tropical zones of the developing world.** In sub-Saharan Africa, for example, arid and semi-arid areas are projected to increase by 60 million to 90 million hectares, while in Southern Africa, it is estimated that yields from rain-fed agriculture could be reduced by up to 50 per cent between 2000 and 2020.[11] Estimates suggest that a 4°C rise in temperature (by 2100 under a high end emissions scenario) may reduce cereal crop yields in South East Asia by up to 5 per cent.[12] By 2080, 600 million additional people (to the current 925 million), could be at risk of hunger as a direct result of climate change.[13]

At the same time, **the global climate is being influenced by greenhouse gas (GHG) emissions *from* conventional, industrial agriculture**, which is responsible for between 11 and 15 per cent of total global emissions[14], or as much as 30 per cent when considering land-use change, including deforestation driven by agricultural expansion for food, fibre, and fuel.[15] The sector is also responsible for nearly 60 per cent of nitrous oxide (N_2O) emissions, mainly from chemical fertilisers, and for about 50 per cent of methane emissions (CH_4), much of which comes from livestock.[16]

Despite these consequences, the **conventional industrial farming model has been largely preserved and is continuing to grow, replacing the local, decentralised small-scale food systems[17] connected to traditional cultures, climates, geography, and ecosystems.**[18] Conventional agriculture is based on Green Revolution technologies which spread worldwide since the mid-1960s. Many crop scientists, public agricultural research centres, multinational seed companies, and various philanthropic organisations believe that a "second" Green Revolution – based largely on biotechnology, the use of genetically modified (GM) high yield herbicide-resistant seeds, and their associated fertilisers, pesticides and cropping systems – hold the key to the current food and climate crisis.[19]

Thanks to the new seeds - accompanied by chemical fertilisers, pesticides, and irrigation - tens of millions of extra tons of grain a year are being harvested. However, the **Green Revolution proved to be irrevocably unsustainable, as it polluted water bodies and degraded soils, caused dramatic loss of biodiversity, agrobiodiversity and traditional knowledge, favoured larger and wealthier farms, indebted a myriad of smallholder farmers around the world, poisoned farmers and farm workers in some cases, and left many marginalised and resource-poor farmers without adequate access to food** (Box 1).[20]

Particularly in Asia, although the Green Revolution's success in expanding food production has helped reduce poverty levels, recent evidence shows that it has resulted in environmental degradation and worsened inequality within countries.[21] In fact, between 1980 and 2000, chemical fertiliser use per hectare increased 11-fold in Vietnam, 6-fold in Thailand and nearly doubled in China.[22] According to the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the overuse of fertilisers in countries in Asia is having detrimental effects on the structure and the nutrient balance of the soil.[23] Unfortunately, since farming practices that depend on chemical fertilisers do not maintain the soil's natural fertility, farmers need to apply ever more chemicals to achieve the same results.[24] In fact, ActionAid's research with farmers in the Irrawaddy Delta region of Myanmar, where farmers suffer from increasing land degradation, has found that yields are falling due to declining soil fertility, but farmers cannot afford to use the ever-increasing amounts of expensive chemical inputs needed to maintain or increase yields. Furthermore, vast areas of cropland, grassland, woodland and forest in Asia have also been lost or degraded as a result of the Green Revolution; in South and Southeast Asia, around 74 per cent of agricultural lands have been severely affected by erosion, wind, water or chemical pollution.[25]

BOX 1.
Has the Green Revolution reduced poverty and hunger in Asia?

Conventional farming's success in expanding food production has helped to reduce poverty levels: in 1975, nearly 3 out of 5 Asians were living in poverty; this declined to less than 1 in 3 by 1995.[26] The per capita availability of calories in Asia increased by 30 per cent during 1970-95.[27] However, the figure of 568 million hungry Asians testifies to the failure to eliminate poverty and hunger. In some countries at the forefront of the Green Revolution, hunger levels have actually risen, as in India, where 225 million people are now undernourished, compared to 177 million in 1990; the proportion of Indians hungry has decreased only marginally, from 20 to 19 per cent during the same period.[28]

Although conventional farming methods have increased yields in Asia's agriculturally optimal areas, they have been less effective in marginalised and resource-poor areas where farmers, especially women, have no access to modern inputs and technologies.[29] Although conventional farming has sometimes benefitted landless people by providing work opportunities on farms, it has also displaced many smallholder farmers as production has been consolidated into large, more concentrated farming systems.[30] In fact, inequalities between regions and farmers have also increased under conventional farming,[31] and millions of farmers have become heavily indebted due to taking out loans to buy expensive external inputs.

In Latin America, the use of chemical pesticides has shifted dramatically from 9 per cent share of sales in 1985 to 21 per cent in 2008, largely due to the expansion of soya bean production, which now covers 16.6 million ha, or 50 per cent of the cropping area of Argentina.[32] Furthermore, the expansion of conventional agriculture during the past two decades has led to the conversion of vast areas of savannah and the Amazon rainforest into croplands integrated with global markets, and it is expected that 22 million more hectares will be converted to farmland, mainly soy fields, by 2020, and most of the Brazilian *Cerrado* (a savannah like vegetation) will disappear by 2030.[33] Not only does this deforestation and land use change contribute to climate change from the release of large quantities of GHGs into the atmosphere, but also negatively affect a wide variety of indigenous peoples and traditional communities – such as the *quilombolas* (descendants of escaped slave communities) and babaçu nut breakers – that depend on natural resources for their livelihoods.[34]

According to the IPCC, the estimated global technical mitigation potential for agriculture is at 5.5 to 6 Gt of CO_2-equivalent per year by 2030.[35] However, as the Special Rapporteur on the Right to Food affirms, this potential will not be realised from conventional agriculture backed by the logic of Green Revolution, as the short-term production gains will be offset by longer-term losses arising from degradation of ecosystems and over-reliance on agrochemicals, which will significantly impede the ability of the future generation to feed themselves and sustain their livelihoods.[36] In fact, **it is estimated that as much as 89 per cent of the mitigation potential from agriculture is likely to come from low-carbon and resource-conserving production methods based on agroecology**[37] (Box 2)**, which ActionAid's CRSA is based upon**. **Despite its enormous potential, agroecology as a long-term strategy to respond to climate change** (Box 3) **has largely been overlooked.**

BOX 2.
Defining agroecology

Agroecology is both a science and a set of practices. It is the application of ecological concepts and principles to the design and management of sustainable agricultural ecosystems, and its practices are based on enhancing the *habitat*, both aboveground and in the soil, in order to produce healthy plants by promoting beneficial organisms while deterring crop pests.[38] In other words, agroecological farming builds the health and resilience of ecosystem functions while reducing the reliance on external inputs such as synthetic chemical pesticides, fertilisers and fossil fuels that have high energy, environmental and health costs.[39] In fact, the findings from the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) show that agroecology is well-suited to withstanding the environmental and economic stresses posed by climate change, shifting pest pressures and volatility in petroleum and commodity prices.[40]

BOX 3.
Brief history of policy responses to climate change

The first major international climate science conference was held in 1979 by the World Meteorological Organisation (WMO), which called on governments to "foresee and prevent potential man-made changes in climate".[41] In 1988, the United Nations Environment Programme (UNEP) and WMO set up the Intergovernmental Panel on Climate Change (IPCC) to assess the state of existing knowledge about the climate system; the environmental, economic and social impacts of climate change; and possible response strategies. In 1992, the United Nations Framework Convention on Climate Change (UNFCC) was created following the 1992 Rio Earth Summit.[42] Signed by 154 nations, it agreed to prevent 'dangerous' warming from GHGs and set *voluntary* targets for reducing emissions. The Kyoto Protocol, signed in 1997 and came into force in 2005, is the first international treaty to set *legally binding* emissions reduction targets for industrialised nations.[43]

The Kyoto Protocol refers to various policy measures, including promotion of "sustainable forms of agriculture", as a way for developed countries to achieve their emission reductions and limitations. The Protocol allows for several "flexible mechanisms", including emissions trading, the clean development mechanism (CDM) and joint implementation to allow Annex I countries (developed countries and economies in transition) to meet their GHG emission limits by purchasing "emission reductions credits (ERCs)" from elsewhere, through financial exchanges and projects that reduce emissions in non-Annex I countries (developing countries), or from other Annex I countries with excess allowances. Essentially, the Kyoto Protocol recognised land use change, forestry sectors, and agricultural activities as both sources of GHG emissions and also as potential sources of carbon offsets[44]. However, these activities were not included in any of the flexible mechanisms due to the issues around permanence and measurement. In addition, although the Protocol offered a pivotal point in establishing commitments to mitigating climate change, it also triggered a political backlash from industrialised countries, particularly the United States, who rejected the treaty on the grounds that: a) complying with the Protocol would negatively affect its economy and put it at a competitive disadvantage; and b) the treaty does not apply to developing countries, including China, currently the largest emitter.

In 2006, the *Stern Review on the Economics of Climate Change*, notable for popularising the adverse economic impacts of climate change, played a key role in re-framing and reviving the international debate on climate change. The document noted that costs and risks of unmitigated climate change will amount to the "equivalent to losing at least 5% of global GDP each year, now and forever" and that damages may even rise "to 20% of global GDP".[45] The Stern Review further advocated that international organisations ought to approach climate change policy through emissions trading, technology cooperation, deforestation reductions, and by enhancing adaptation strategies in the world's poorest countries.[46]

3. Climate Change Mitigation and Adaptation in Agriculture

Mitigation (i.e. reducing the level or rate of GHG emissions that cause climate change) and adaptation (i.e. managing the effects of climate change and reducing risks and vulnerabilities) are two complementary strategies for dealing with climate change. Mitigation schemes in agriculture are broadly regarded as pre-emptive actions that reduce net carbon emissions from food production and limit long-term climate change.[47] On the other end of the spectrum, adaptation schemes in agriculture can be *reactive* to shifting precipitation patterns at the farm-level, for example by changing sowing dates or controlling erosion, and/or *proactive,* which involves wider institutional and policy changes aimed at increasing the resilience and adaptive capacity of agricultural systems, such as redistribution of resources and support for new livelihood options for smallholder farmers.[48] Mitigation and adaptation are undoubtedly inter-linked; the amount of adaptation response necessary will depend partly on the success of mitigation efforts, and at the same time, some interventions such as promoting agroecological farming systems can help facilitate both mitigation and adaptation.[49]

Many mitigation schemes in developing countries, however, are biased against smallholder farmers. Since developing countries contribute less GHG emissions compared to developed countries, mitigation schemes in the former are typically designed to help offset emissions in the latter. This, however, results in perverse incentives that actually *encourage* polluting activities, and shift the blame and responsibility for addressing climate change from conventional farmers in rich countries to the poor smallholder farmers in developing countries – the very people who are least responsible for causing the problem.

On the other hand, adaptation policies implemented in developing countries are fragmented and are faced with the challenges of insufficient human capacity and financial resources, causing many solutions to be approached sectorally and top-down.[50] While there are no precise figures, the UNFCC estimates that US$14 billion will be needed globally by 2030 as additional annual investments to cover the costs of adaptation in agriculture, forestry and fisheries[51]; and the World Bank and the International Food Policy Research Institute (IFPRI) project an annual investment of US$7.1-7.3 billion required for developing countries (with Sub-Saharan Africa requiring 40 per cent of the total with greatest share of investments needed in roads, Latin America in agricultural research, and Asia in irrigation efficiency).[52] Despite the recognition of these staggering costs, the current adaptation deficit in agriculture is extremely high.[53] What is more problematic is that **public finances are being wasted on false solutions in the form of biofuels, soil carbon markets, and "Climate-Smart Agriculture", which can potentially cripple the livelihoods of the world's most vulnerable communities, and worsen the climate crisis in the long-run.** These false solutions will be scrutinised one by one in the following section.

4. False Solutions to Climate Change

Biofuel Production

Biofuel is seen as one of the prominent options for climate change mitigation, despite growing controversy on its outcomes. Driven by the urgency to reduce carbon emissions, diversify energy sources, and avoid fossil fuel use, feedstock biofuel production has rapidly expanded over the last decade. Between 2007 and 2009, global biofuel, in averages, was purposed for 20 per cent in the case of sugar cane, 16 per cent for vegetable oils, 15 per cent for corn, and 4 per cent for sugar beet.[54]

In terms of environmental benefits, available data is inconclusive as to the actual GHG emission offsets that biofuels offer.[55] According to the FAO, studies of corn-based ethanol demonstrate that the process of manufacturing this biofuel "actually contributes more to GHG emissions than the burning of most fossil fuel".[56] Moreover, the production of biofuels can lead to indirect land use change (ILUC) – i.e. additional deforestation and land conversion of fragile ecosystems. When existing agricultural land is converted to biofuel production, agriculture has to expand elsewhere to meet the previous and ever-growing demand for crops for food and feed – often at the expense of forests, grasslands, peat lands, wetlands, and other carbon rich ecosystems. This in turn leads to substantial increases in GHG emissions as a consequence of the release of carbon locked up in soils and biomass.[57] According to a comprehensive study by the Institute for European Environmental Policy (IEEP) in 2010, the European Union (EU)'s plans for increasing biofuel production by 2020 will result in the conversion of up to 69,000 km^2 of land to agricultural use due to ILUC globally, with total net GHG emissions being as much as 56 million tonnes of extra CO_2 per year.[58] Another study commissioned by ActionAid and its partners in 2011 found that – assuming typical conditions and yields – GHG emissions from jatropha biofuel production in Kenya will be 6 times higher than fossil fuel equivalents, principally as a result of the destruction of woodland and scrubland that will be required to plant the jatropha. [59] Furthermore, the widespread use of chemical fertilisers and pesticides, and the use of heavy machinery and irrigation in large-scale biofuel monocultures may weaken soil productivity, water quality and availability, and biodiversity in local ecosystems.[60]

Not only harmful to the environment, biofuel production entails irrevocable social costs. For instance, certain pesticides' toxicity compromise the health of both field workers exposed directly to the chemicals, as well as the local communities, since toxins leach into local groundwater sources.[61] In particular, women are especially susceptible to hazardous working conditions on plantations when compared to men, as they are often disadvantaged in their wages, training, and exposure to safety hazards.[62] Furthermore, biofuel production puts great pressures on local communities' land rights as millions of hectares of land in the global south are being acquired by private companies and foreign investors. In areas such as the Dakatcha Woodlands in Kenya, communities are at the risk of being evicted from their own land by private companies who move in and clear the land for biofuel plantations.[63] In Brazil, the expansion of monoculture sugar cane has resulted in the removal of smallholder farmers from their land, increased unemployment and violation of labour laws[64], and exacerbated household food insecurity. For example, in Mirassol d'Oeste and Lambari d'Oeste, municipalities in the southeast of Mato Grosso State of Brazil, sugar cane businesses now occupy vast areas of land that were once established by family farms to grow rice, beans, and manioc (cassava), and the plantation workers face degrading working conditions, frequently compared to slave labour.[65] Indeed, according to a recent report for the International Land Coalition (ILC), "the allocation of large land areas to outside investors can always be assumed to mean the dispossession of local land users, and their exclusion from resources that are critically important to their livelihoods".[66]

Soil carbon markets

International actors such as the World Bank, the UNFCC, the FAO, and other multilateral agencies have supported project-based carbon trading (Box 4) **as an untapped resource to reduce emissions from land-use change in agriculture.** This market-based mitigation strategy is largely based on soil carbon sequestration, a biological process of capturing carbon dioxide from the atmosphere into the soil through crop residues and other organic matter.[67] In fact, the IFPRI estimates the technical potential of soil carbon sequestration globally to be as high as 2 billion to 3 billion metric tonnes per year for the next 50 years.[68] Similarly, the FAO has argued that "soil carbon sequestration on agricultural land alone might offset the effects of fossil fuel emissions and land use change for one or two decades or even longer."[69]

BOX 4.
Categories of carbon trading[70]

There are two conceptually different categories of carbon transactions. The first is **allowance-based transactions** in which carbon units are *allowances* or units that guarantee the "right to pollute". Allowances are created and assigned by regulatory cap-and-trade regimes in compliance markets. **Compliance markets** exist where there are laws and regulations mandating emission reductions, and where those laws also allow regulated entities to offset some of their emissions by paying someone to reduce emissions for them somewhere else. Current cap-and-trade regimes include the International Emission Trading (IET) under the Kyoto Protocol which generates tradable carbon units known as Assigned Amount Units, and the European Union Emissions Trading Scheme (EU-ETS), which generates EU Allowances (EUAs).

The second is **project-based transactions**, in which carbon units are *carbon credits,* often referred to as carbon offsets or emission credits. These credits are generated in various projects that aim to negate or neutralise a given amount of GHG emissions released in one place by avoiding the release of the same amount elsewhere, or by absorbing the equivalent amount through carbon sequestration. The Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI) schemes are examples of project-based mechanisms, and the traded units in each market are known as Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) respectively. Project-based transactions are also used by smaller voluntary carbon markets, which operate outside international agreements. **Voluntary markets** are used by those who wish to purchase carbon credits to offset their emissions, whether out of personal conviction or in an effort to project an environmentally responsible image. Currently, the global voluntary market is a fraction of the size of the compliance market. In 2009, soil carbon credits made up 3 per cent of the credits traded on the voluntary market, up from 0.5 per cent in 2008; and the average price for these credits was US$ 1.20 per tonne.[71]

The soil carbon market is bolstered by the following two attractive propositions: 1) industrialised countries would be able to meet their emission reduction targets without drastically modifying their own emissions behaviour; and 2) developing countries that participate in carbon markets through soil carbon sequestration can gain access to new sources of income. In this way, soil carbon markets are claimed to support the dual goals of curbing climate change and reducing poverty. The IPCC reports that these goals can be accomplished in many ways – e.g. through improving grazing and crop management, cultivating degraded lands, and modifying fertiliser applications.[72] The FAO includes "conservation tillage, nutrient management, rotational grazing and improved forage management, and the use of cropping rotations and cover crops" as other agricultural practices to maximise carbon offsetting.[73] **However, a number of serious concerns remain unaddressed in the popular conversations about carbon trading.**

First, **there is no soil carbon market**. In fact, the European Emissions Trading System (EU-ETS) – currently responsible for 98 per cent of the compliance market – does not allow credits from soil carbon to be traded; these rules are in place until at least 2020.[74] In the absence of a compliance market outlet for soil carbon credits, the World Bank and other market proponents are currently banking on the potential of voluntary markets to generate revenues from soil carbon trading.[75] However, there are **scientific uncertainties about the quantification and verification of soil carbon,** as well as the issue of **non-permanence** of sequestered carbon that render soil carbon trading a non-viable option. In terms of measurement, soil carbon cannot be measured with the precision required for commodity investors, and having different measurement methods and data availability from project to project means that there is no standard definition of the commodity.[76] Furthermore, the rate and amount of soil carbon sequestration varies according to soil characteristics, seasons, precipitation, human intervention and climate change.[77] As a report by the World Association of Soil and Water Conservation crudely puts it: "even the highest level of accuracy will not allow for the fact that soil organic matter will be moved by erosion over time and one may not know whether it has moved only a few inches from the sampling point or has ended up jammed against a dam 100 miles away". [78] Moreover, sequestered soil carbon is non-permanent, meaning that sooner or later, the sequestered carbon will be released again into the atmosphere due to various reasons, including natural disasters, pests, and land-use changes.

Second, it is **unclear whether smallholder farmers will receive any revenues from carbon markets**.

In theory, carbon markets are designed to generate new sources of income for smallholder farmers. However, the high transaction costs associated with soil carbon schemes – including negotiation, approval, administration, monitoring, enforcement, and insurance costs – means that most of the revenue generated through carbon sequestration projects will go to intermediaries and project developers; leaving little or no cash benefits for farmers themselves.[79] Indeed, the price for soil carbon will be highly discounted to address the issues, such as non-permanence, uncertainties, payments to intermediaries, and other risks that might trouble investors. For example, if a tonne of carbon is worth US$ 2 on the voluntary market, this may be discounted by as much as 60 per cent to address the risks of non-permanence, and 40 per cent of the gains will likely go to project intermediaries, with the farmer taking home as little as US$ 0.25.[80] In addition, because sequestration is most productive in higher quality soil, any revenue generated that actually reaches the farmer will go to more resource-rich landowners than marginal farmers.[81]

Third, **even if there were a soil carbon market, the system would be biased against smallholder farmers**. In fact, soil carbon sequestration requires long-term commitment and binds farmers to utilise certain types of agriculture and land management practices.[82] However, prescribing a package of 'best' management practices that score highest on sequestration rates might in fact undermine farmers' dynamic and diverse adaptation strategies, and thus increase rather than reduce their vulnerability to climate risk.[83] In addition, the expansion of soil carbon markets encourages private actors to extend their control over land without taking into account local land tenure arrangements, and often at the expense of smallholder and marginal farmers who do not have equal negotiating power compared to large landowners.[84] The issue of land rights are particularly precarious for groups with little political decision-making power at local or national levels, such as women and pastoral herders.[85]

Fourth, **in order to sustain financial returns from soil carbon markets, developed countries need to keep emitting GHGs.** Instead of facing head-on the difficult task of reducing emissions domestically, developed countries are designing elaborate offsetting schemes that avoid reducing their own emissions, while at the same time, redirecting the conversation towards the 'marvellous mitigation potential' that exists in developing country agriculture. Such schemes do not reduce global GHG emissions; instead, they merely relocate emissions somewhere else until sooner or later the gases return to the atmosphere. Furthermore, they shift the responsibility of reducing carbon emissions away from those that are most responsible for past, present and future emissions, and onto those that are least responsible and unable to control the terms of their participation.[86] Unless there are real emission reductions by developed countries, smallholder farmers will continue to suffer and a global climate crisis will not be averted.

Lastly, **soil carbon markets lead to significant misallocation of public resources for climate change adaptation and agricultural development**.[87] Resilience of smallholder agricultural systems and food security should be the guiding objectives of the adaptation agenda, not the creation of soil carbon markets. However, policymakers are more distracted by the need to create market-friendly institutions than financially supporting smallholders to adapt to climate change. As mentioned in the previous section, the cost for climate change adaptation is immense and requires concerted effort by national governments and donors alike. However, rich countries are avoiding the difficult question of where and how to mobilise public resources, and are rather pinned on developing private financing mechanisms via elusive soil carbon markets. In addition to the significant resources being invested to set up soil carbon markets, the World Bank is also pouring money at the country level to develop policy and institutional frameworks to enable soil carbon trading.[88] For instance in Kenya, the World Bank is supporting the development of an institutional framework for facilitating soil carbon trading via "Climate-Smart Agriculture", and the identification of financial instruments which have the potential to scale-up such initiatives.[89]

The following section will critical examine Climate-Smart Agriculture – an agenda widely promoted by multilateral organisations, including the World Bank, the FAO, the International Fund for Agricultural Development (IFAD), the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), the African Union (AU), and the World Food Programme (WFP) – which comes packaged with soil carbon markets.

Climate-Smart Agriculture

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) in its 2009 Synthesis Report called for **"a shift from current farming**

practices to sustainable agriculture systems capable of providing both significant productivity increases and enhanced ecosystem services."[90] In June 2011, a major **FAO study, *Save and Grow*, has reiterated a call for substantial changes throughout the world's food system, including sustainable intensification, or sustainable crop production intensification (SCPI)** to simultaneously increase yields, improve efficiency in the use of inputs, and reduce negative environmental impacts arising from intensive crop production related to the Green Revolution.[91] According to the FAO, SCPI represents "a major shift from the homogenous model of crop production to knowledge-intensive, often location-specific farming system", and includes practices such as integrated soil and water management, conservation of plant genetic resources, and integration of pest and disease management – all of which ActionAid supports.

What is problematic, however, is that SCPI comprises a key element of Climate-Smart Agriculture *along with* soil carbon markets. According to the World Bank, Climate-Smart Agriculture is a "triple-win solution" as it seeks to "increase productivity in an environmentally and socially sustainable way, strengthen farmers' resilience to climate change, and reduce agriculture's contribution to climate change by reducing GHG emissions and *increasing carbon storage on farmland*" [emphasis added].[92] Indeed, the World Bank and the FAO are supporting the expansion of carbon markets into developing countries by using "carbon finance as a 'lever' to promote sustainable agricultural practices"[93] in developing countries. **However appealing the "triple-win solution" may sound, Climate-Smart Agriculture is a Janus-faced strategy, claiming environmental, social and economic sustainability while making smallholder farmers in developing countries dependent on the unlikely emergence of soil carbon markets**.

The major loophole in the packaging of carbon trading within Climate-Smart Agriculture is that it is, as aforementioned, **premised on sales to a non-existent soil carbon market along with other inherent flaws in the system.** In the meanwhile, the FAO has suggested the **incorporation of REDD+ (Reducing Emissions from Deforestation and Forest Degradation) under Climate-Smart Agriculture** through a "landscape approach", calling for future policy framework to recognise "carbon stock and mitigation potential from all land uses, foster an integrated approach to resource management and build close linkages between REDD+ and agriculture".[94] However, according to the Munden Project, which analysed REDD projects and the suitability of forest carbon as a commodity: "The process by which forest creates carbon is ill defined to the point of being unacceptably risky. It contains a vague, poorly defined, and scientifically unreliable process for creating forest carbon...As a consequence, pushing these commodities through derivatives trading framework will prove impossible."[95] By the same token, as with soil carbon markets, **forest carbon markets via REDD will provide a smokescreen for rich countries' failure to reduce emissions and provide adequate funds to help developing countries adapt to climate change** (Box 5).

BOX 5.
Increasing attention for the value of forest carbon stocks

UN's Reducing Emissions from Deforestation and Forest Degradation (REDD) Programme and REDD+ (which goes beyond REDD to include conservation, sustainable management of forests and enhancement of forest carbon stocks) [96] are increasingly being pushed to become another carbon trading mechanism. As currently conceived, REDD involves payments to developing countries that will prevent deforestation or degradation that would otherwise have taken place. There is currently no formal mechanism for REDD with international recognition under the Kyoto Protocol and still undergoing negotiations under the UNFCC, but a number of REDD projects have already sprung around the world.[97] According to a study by Friends of the Earth International, REDD has attracted a myriad of different agents, including carbon traders and investors, plantation companies, and even oil and gas companies, specifically "with a view to making a handsome profit from carbon trading when REDD is agreed in the UNFCC".[98]

In addition, **soil carbon markets could easily lead to carbon offsets for genetically modified (GM) crops and increased land speculation and land grabs**. While official documents do not make this explicit, the World Bank's definition of sustainable intensification in its policy briefing on Climate-Smart Agriculture – "increase[ing] yield per unit of land to meet today's needs without exceeding current resources or reducing the resources needed for the future"[99] – could mean replacing small-scale agriculture with industrial conventional agriculture and its attendant Green Revolution technologies, which smallholder famers cannot afford. In fact, large agrochemical and seed corporations are currently developing "climate-ready" crops, and pressuring governments to allow what the ETC group calls, "the broadest and most dangerous patent claims in intellectual property history".[100]

Moreover, the **"social sustainability" of Climate-Smart Agriculture is questionable** as smallholder farmers will have to shoulder the double burden of satisfying the increasing global demands for food supply and carbon storage. More critically, the burden will fall most heavily on women smallholders who are indispensable food producers, providers and carers, but who do not have equal access to and control over natural and productive resources, information and decision-making processes compared to men. Climate-Smart Agriculture also pays little attention to not only women's particular vulnerability to the impacts of climate change, but also their resourcefulness and creativity in coping with climatic shocks and finding alternative solutions.[101] In sum, the conversation on Climate Smart Agriculture then boils down to utilising smallholder farmers to supply carbon credits and food, rather than about building their long-term resilience to climate change.

5. Defining Climate Resilient Sustainable Agriculture as a Real Alternative to False Solutions

It is clear from observing the limitations of contemporary climate change policy that there must be an alternative towards more socially just, economically viable, and environmentally sound agriculture that improves the livelihoods and builds the resilience of smallholder farmers, without instrumentalising them. In this light, ActionAid's Climate Resilient Sustainable Agriculture (CRSA) provides a feasible alternative.

CRSA is based on the science and practices of agroecology, and it contributes to both climate change mitigation and adaptation. It contributes to climate change mitigation not only by capturing carbon in soil organic matter and above-ground biomass, but also by avoiding emission of carbon dioxide and other GHGs from farms by reducing direct and indirect energy use.[102] More significantly, as a myriad of evidence shows, agroecological farming methods can cushion the negative impacts of extreme weather-related events as a result of climate change. In fact, throughout history, many rural communities and traditional farming households, despite weather fluctuations, have been able to cope with climatic extremes.[103] In fact, many farmers cope and even prepare for climate change, minimising crop failure through various techniques, such as using drought tolerant local varieties, harvesting rainwater, soil conservation, mulching, and practicing mixed cropping, crop rotation, and agroforestry.

Agroecology is knowledge-intensive and context-specific, and its techniques are used and disseminated through farmers' knowledge and experimentation. With this understanding, ActionAid promotes a three-prong approach to CRSA:

1) Conducting participatory appraisals to identify local conditions, potentials and challenges for making the transition to agroecological farming systems;
2) Identifying, documenting, testing, and disseminating local knowledge and alternative agroecological practices and encouraging local innovation;
3) Promoting long-term sustainability through appropriate agricultural research and extension services based on technologies that reduce the dependence on external inputs and agro-chemicals, help farmers adapt to climate change, and build on and reinforce local knowledge.

The actual practices of CRSA are based on seven key pillars:

Gender equity and women's rights

Women comprise an average of 43 per cent of the agricultural labour force of developing countries and they play a major role in ensuring food security.[104] Many women are repositories of knowledge about cultivation, processing and preservation of nutritious and locally adapted crop varieties. Such knowledge can almost be exclusive to women, often directly related to their specific roles within food production, and allows women to play a leading role in promoting agroecological innovations. For example, ActionAid Brazil's 'Women and Agroecology' project has demonstrated that when given an opportunity to generate and share agroecological knowledge among women, they were not only able to improve production methods, but also able to become "more autonomous and achieve greater power at productive, reproductive and community levels".[105]

Despite their wealth of knowledge and capacity, women farmers are not recognised as productive famers by their own communities and by policymakers, and do not have equal access to natural and productive resources compared to men. Their time is also constrained by the dual responsibilities for unpaid care work and agricultural labour, and in many cases, structural gender inequality impedes their participation in agriculture and enterprise. In light of these challenges, ActionAid brings women's rights to the core of CRSA – improving women's access to and control over productive resources; promoting group dynamics and collective action among women farmers; increasing women's contribution to household incomes through training in financial literacy and marketing skills; and optimising or reducing women's time spent on care and reproductive work.

Soil conservation

Soil is one of the most important components of CRSA. As a living organism, soil demands care and needs to be provided with organic materials so that it can offer the right kinds of nutrients to the plants. Important part of the soils in developing countries, particularly arid and semi-arid areas, are very old (in geological terms), which means that the clay of the soils cannot retain a lot of nutrients. In such conditions, soil organic matter plays an important role in "keeping" nutrients as it can prevent them from being washed away by water. It also plays an important role in maintaining the soil moisture, soil structure and protecting the soil against erosion. For example, on-farm experiences in Chiang Mai Valley of Thailand have demonstrated that incorporating green manure (*Sesbania rostrata*, a biological nitrogen fixing plant) increased soil nutrients and soil fertility without using chemical fertiliser, and it increased the dynamic of soil organic matter, reduced producing costs and generated additional income for low-land rice farmers.[106]

Soil organic matter is central even in conventional production systems; soil that has little organic matter cannot hold chemical (and highly soluble) fertilisers, and part of the expensive chemical fertilisers can be washed away by water. This is not only a waste of time and money, but it also demonstrates the inefficacy of conventional farming in the absence of proper soil management. Most smallholder farmers have access to very poor soil (with low organic matter content), due to the natural low fertility of marginal lands or due to overexploitation. Since the soils are already depleted, many smallholder farmers depend on very expensive chemical fertilisers as the only alternative to ensure food production. In this vein, ActionAid is proposing a gradual reduction in the dependence on chemical fertilisers through a committed investment on improving the soil health and enhancing the dynamics of soil organic matter.

Sustainable water management

According to the IPCC, many semi-arid and arid areas are particularly exposed to the impacts of climate change and are projected to suffer a decrease in water resources due to climate change.[107] Furthermore, increased precipitation intensity and variability are projected to amplify the risks of flooding and drought in many areas.[108] Such abnormality in rainy seasons can result in severe consequences for agricultural and rural development, including decreased water availability in terms of quantity and quality, increased erosion and soil depletion, damaged crop fields, increased livestock death, destruction of infrastructure which impedes physical mobility and market access, increased disease epidemics, and negative overall impacts on livelihoods.[109] With rain-fed agriculture providing nearly 60 per cent of global food value on 72 per cent of harvest land, rainfall variability is a critical challenge for smallholder farmers in tropical and sub-tropical agricultural systems.[110]

To deal with the erratic changes in the rainfall, smallholder farmers in dryland areas have been and are currently using various traditional water management techniques. For example, they have built indigenous systems to harvest rainwater not only for domestic consumption, but also for livestock rearing and crop production. These systems include roof-catchment systems (guttering), small dams (e.g. underground, sand, earth dams), brick tanks, rock cisterns and other types of reservoirs. Such methods have not only helped farmers to conserve water, but also to control soil erosion and run-off, and to make use of preserved water for agriculture during dry periods. In the semi-arid regions of Brazil, for instance, the dissemination of decentralised rainwater capture and management systems such as plate cisterns have enabled smallholder farmers to coexist with the large variability of the region's climate.[111] Building on their traditional knowledge, ActionAid's CRSA encourages sustainable water management through water catchment systems and rainwater harvesting at the community level; on-farm water preservation systems; small, low-cost irrigation systems such as drip/micro irrigation and treadle pumps; and hydroponics (soil-less agriculture) in water-logged areas.[112]

Agrobiodiversity preservation

Agrobiodiversity, or agricultural biodiversity, includes all the components of biological diversity relevant to food and agriculture, as well as those constitute the agro-ecosystem – i.e. "the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which sustain the functions, structure and processes of the agro-ecosystem".[113] Traditional small-scale farmers tend to grow a wide variety of cultivars, and are the natural creators and preservers of agrobiodiversity. Many of these cultivars are landraces, meaning that they are more genetically heterogeneous than modern (deliberately-bred) varieties, and are grown from seeds that are passed down from generation to generation. Most importantly, these landraces are more adapted to the natural and cultural environment in which they live, and hence, offer greater defences against vulnerability and enhance harvest security in the midst of diseases, pests, droughts and other stresses.[114] In fact, many researchers have concluded that variety richness leads to greater enhanced productivity and less yield variability. [115]

The Special Rapporteur on the Right to Food emphasised in his report on agroecology that resilience to extreme weather-related events is "strengthened by the use and promotion of agricultural biodiversity at ecosystem, farm system and farmer field levels".[116] In this light, through CRSA, ActionAid seeks to preserve agrobiodiversity by building poor people's control over their local knowledge and heritage while reducing the dependency on external inputs; organising community and micro regional seed and gene banks; conserving local crop varieties, livestock and fish species; promoting participatory breeding of plants and animals; and encouraging the collective multiplication of seeds to ensure farmers' access to quality seeds at the right time.

Livelihood diversification

Not only the diversity of species, but also the diversification of farm and livelihood activities that agroecology allows plays a crucial role in mitigating risks from extreme weather-related events and other shocks. Livelihood diversification through mixed cropping or polycultures, for example, can also contribute to balancing soil nutrients, preventing weeds and pests, reducing plant diseases, increasing the overall efficiency and productivity of the land, improving health and nutrition through more diverse, nutritious and fresh diets, and reducing the needs for pesticides with positive impacts on the reduction of the incidences of pesticide poisoning among farmers, communities and consumers. Moreover, these diversified farming systems in which smallholder farmers produce grains, fruits, vegetables, fodder and animal products in the same field or garden out-produce the yield per unit of single crops, such as corn or soybeans, grown alone on large-scale farm. For example, although a large monoculture farm may produce more corn per hectare than a small farm in which corn is produced as part of a polyculture, the productivity in terms of harvestable products per unit area is higher for the latter. Yield advantages for a multiple cropping system can range from 20 to 60 per cent, because it reduces losses incurred from weeds, insects and diseases due to the presence of multiple crop species, and it makes more efficient use of the available resources of water, sunlight, and nutrients.[117] By making the most out of the limited resources, smallholder farmers under a mixed cropping system are able to reduce the costs of production and make more profit per unit of output and hence more total profits, even though the production of each commodity is less when compared to a monocropping system.[118]

ActionAid supports livelihood diversification in various ways, including: promoting mixed, inter/multi-cropping to reduce the risk of crop failure, increase incomes, and improve dietary balance and nutrition; promoting agroforestry – integrating trees with crops, grass and vegetables – to reduce soil erosion, improve soil fertility, and increase and diversify household income; supporting integrated crop-livestock farming and enhancing the production of animal fodder as a way to ensure accessibility to animal manure and to increase the availability of organic materials to cover the soil.

Improved processing and marketing

The Special Rapporteur on the Right to Food in his recent report on value chains acknowledged that small-scale farmers, herders and fishers in many developing countries could be the primary beneficiaries of strengthened local and regional markets.[119] Indeed, considering that agriculture constitutes 50 to 90 per cent of the income for rural households, the development of efficient agricultural markets has a large impact for enhancing their economic opportunities.[120]Rural households, however, face a number of constraints in processing and marketing.

For instance, smallholder farmers face high marketing costs and risks stemming from vulnerability to weather, pest and crop diseases, poor transportation infrastructure, lack of credit, lack of market and price information, lack of competitive markets, lack of training on value-addition, unfavourable government policies (overregulation or sporadic intervention), commodity price volatility, and cultural stereotypes that impede women's mobility and participation in markets. In fact, marketing costs in Sub-Saharan Africa are up to 70 per cent of retail values, which means that the effective price that farmers receive for their products are dramatically reduced.[121]

Women farmers, in particular, are typically caught up in petty trading, buying and selling small volumes directly for retail in local markets, while men tend to predominate in wholesaling into regional and international markets.[122]

To address these constraints in market access, ActionAid encourages decentralised processing units to increase and diversity farmers' income and improve product quality; value-addition and marketing of both food and non-food products; improved links between local producers and consumers through appropriate infrastructure, market information and gender-equitable value chain development; and exploration into other possible markets such as public procurement and institutional markets.

Supporting farmers' organisations and collective action

Collective action is a powerful means for farmers to increase productivity and access to markets whilst sharing knowledge, information and productive assets, and building confidence and self-esteem. Collective structures such as producer associations, collectives or cooperatives can facilitate the sharing learning processes and strengthen farmers' skills in crop production, animal husbandry, processing, packaging and marketing, improve their negotiating skills and bargaining positions in market places, and improve their ability to contribute to the design and implementation of public policies that affect them. For example, in the Philippines, it has been found that the total income of farmers practicing sustainable agriculture and participating in group marketing through the farmer network MASIPAG (Farmer-Scientist Partnership for Agricultural Development in the Philippines) is about 45 per cent higher than the income of other conventional farmers.[123]

In addition to the economic benefits, group dynamics can be socially and politically empowering especially for women, providing them with opportunities to participate in policy decision-making and take on leadership roles. Women-only groups can provide "enabling spaces" where marginalised women can gain self-esteem, confidence, and skills by creating a space for them to identify their needs, understand their rights, and begin to articulate their demands. To strengthen farmers' organisations and promote collective action, ActionAid is supporting the establishment and strengthening of women farmers' associations, farmers' cooperatives, unions and landless movements; building partnerships with local farmers' organisations, producer cooperatives, national farmers; associations and regional and internal farmers' networks; increasing the capacity of farmers' organisations to influence public policies on agriculture and climate change and to scale up agroecology.

6. Conclusion and Recommendations

Biofuels, soil carbon markets, and Climate-Smart Agriculture are three responses to climate change that are increasingly gaining popularity among policy circles. However, as this paper shows, the three solutions are essentially flawed and unjust as they incentivise rich countries to shirk their legal obligations to reduce their carbon emissions while shifting the burden onto poor countries. Moreover, they misallocates public resources which could otherwise be invested in meaningful adaptation strategies, and do little to consider gender and livelihood impacts on smallholder farmers.

In a sea of false solutions there is a dire need for a real alternative, and ActionAid's CRSA has a potential to become one. Moving away from market-based climate change policies that instrumentalise smallholder farmers – often at the expense of their food security, human rights, and livelihoods, and to the benefit of investors, carbon traders, and large-scale farms – CRSA starts from the recognition of the people's rights, knowledge, vulnerabilities, and the context-specific nature of agroecosystems worldwide. Scaling up this real alternative, however, will require committed and concerted effort from national governments, donors, and public agricultural research centres.

In order to scale-up CRSA, existing food and agricultural systems, policies, and practices must be transformed. In this regard, national governments, with support from donors and international institutions, must embark on the following initiatives:

- **Draw up national sustainable agriculture strategies, focused on ensuring food security and adapting to climate change**. These strategies should outline:
  - how governments will prioritise their support for smallholder farmers, notably women, in promoting sustainable agriculture;
  - what kind of support smallholder farmers will receive;
  - how farmers themselves will be involved in policy design and implementation;
  - what kind of investments are needed to promote these strategies, and to make the transition away from conventional farming; and
  - how farmers' own knowledge and creativity will be incorporated in the process of building sustainable alternatives.

- **Design and implement climate change risk reduction strategies based on:**
  - the identification of the main *impacts* of climate change on smallholder agriculture, as well as the *risks* that smallholder farmers are currently facing and may face in the future; and
  - the implementation of *early warning systems* to increase the preparedness of farmers to unexpected rains, floods, and dry periods.

- **Phase out input subsidy schemes for agro-chemicals (chemical fertilisers and pesticides) in favour of those that promote sustainable agriculture.** Such subsidy programmes should:
  - embrace *gender equity and women's rights* as a matter of principle;
  - promote *soil conservation*;
  - promote *sustainable water management*;
  - champion *agrobiodiversity preservation*;
  - support *livelihood diversification*;
  - strengthen decentralised *processing*, and improve smallholders' *access to markets;* and
  - support *farmers' organisations and collective action*

- **Re-orient agricultural research and extension services and create 'knowledge hubs' to support smallholder farmers in promoting sustainable agriculture in the context of climate change.** National governments must:
  - increase public spending on extension services, improve training for extension agents, and reach greater number of farmers than they currently do;
  - train more female extension agents to support women farmers' adaptation to climate change and to provide services that are tailored to their routines and needs;
  - ensure that new extension services are

farmer-driven and build bridges between local and scientific knowledge, so as to encourage local innovation and to reduce the dependency on external inputs;
- promote on-farm research on smallholder farmers' agroecological practices;
- develop publicly-bred and managed seed varieties that are resistant to droughts, floods, and pests; and
- step up support for improved water and soil management, and incentivise practices such as rainwater harvesting, on-farm water preservation, and low-cost irrigation systems.

- **Provide credit programmes at low-interest rates and long pay-back periods to help smallholder farmers make the transition to sustainable agriculture.** For example, governments should provide credit for local, organic, non-fossil fuel-based agricultural inputs and farming methods that have proven to be effective in climate change adaptation, and help smallholder farmers invest in marketing and processing.

- **Promote community banks of grain, seeds, biomass, fodder, and storage facilities at the local level,** to increase food security and food sovereignty, preserve local varieties, facilitate farmers' access of to quality seeds, and prevent local genetic materials from becoming lost due to climate change.

- **Promote extensive land reforms to increase the security of tenure for smallholder farmers and ensure that such laws apply equally to women farmers.**

- **Strengthen social assistance programmes such as food and cash transfers**. Guaranteed employment schemes could employ large numbers of people in forest conservation and integrated watershed development. School feeding programmes and public food distribution systems could procure food from smallholder farmers practicing sustainable agriculture.

Endnotes

[1] International Institute for Environment and Development (IIED). 2011. 'Mainstreaming Environment and Climate Change'. *Agriculture Briefing*, April. Available at: http://pubs.iied.org/pdfs/G03098.pdf.
[2] ActionAid International. 2008. *The time is NOW: Lessons from farmers adapting to climate change*. Johannesburg: ActionAid International. Available at: http://actionaidusa.org/assets/pdfs/climate_change/the_time_is_now.pdf.
[3] Intergovernmental Panel on Climate Change (IPCC). 2007. 'Summary for Policymakers'. In M.L. Perry et al. (Eds). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, p. 7-22.
[4] Lobell, D. B. et al. 2008. 'Prioritizing Climate Change Adaptation Needs for Food Security in 2030'. *Program on Food Security and the Environment Policy Brief*. Available at: http://iis-db.stanford.edu/pubs/22099/science_policy_brief.pdf.
[5] Ibid.
[6] Dixon, J. et al. 2001. 'Summary. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World'. Rome: FAO. Available at: ftp://ftp.fao.org/docrep/fao/004/ac349e/ac349e00.pdf.
[7] ActionAid International. 2008. *The time is NOW: Lessons from farmers adapting to climate change*. Johannesburg: ActionAid International, p. 2.
[8] ActionAid International. 2011. 'False Solutions for Real Problems'. *Policy Brief*. Johannesburg: ActionAid International. Available at: http://www.actionaid.org/sites/files/actionaid/false_solution_for_real_problems.pdf.
[9] IPCC. 2007. "19.3.6 Extreme Events". In M.L. Perry et al. (Eds). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available at: http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch19s19-3-6.html.
[10] World Bank. 2008. *World Development Report 2008: Agriculture for Development*. Washington DC: World Bank. Available at: http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf.
[11] IPCC. 2007. *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, eds). Cambridge and New York: Cambridge University Press, Chapter 9, p. 448.
[12] Parry, M.L., et al. 2004. 'Effects of climate change on global food production under SRES emissions and socio-economic scenarios'. *Global Environmental Change*, 14, pp. 53-67.
[13] United Nations Development Programme (UNDP). 2007. *Human Development Report 2007/2008. Fighting Climate Change: Human solidarity in a divided world.* New York: UNDP, p. 90.
[14] The IPCC estimates 10-12 per cent (http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter8.pdf), the OECD 14 per cent (http://www.oecd.org/document/18/0,3746,en_21571361_43893445_44437010_1_1_1_1,00.html), and the World Resources Institute (WRI) 14.9 per cent (http://pdf.wri.org/navigating_numbers.pdf).
[15] Meridian Institute. 2011. *Agriculture and Climate Change: A Scoping Report*. Washington, D.C.: Meridian Institute. Available at: http://www.gscsa2011.org/LinkClick.aspx?fileticket=dAJxg2imVx8%3D&tabid=3251.
[16] Smith, P., D. et al. 2007. 'Agriculture'. In B. Metz et al. (Eds). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, Chapter 8.
[17] It is estimated that over 350,000 rice and corn farmer livelihoods in developing countries are being destroyed due to a conversion of acreage by large corporations devoted to cut flowers for export to western markets.
[18] International Forum on Globalisation (IFG). 2007. 'The Rise and Predictable Fall of Globalised Industrial Agriculture'. San Francisco: IFG, p. 7.
[19] ActionAid International. 2009. *Assessing the Alliance for Green Revolution in Africa (AGRA)*. Johannesburg: ActionAid International. Available at: http://www.actionaid.org/sites/files/actionaid/aai_report_-_assessing_agra.pdf.
[20] Rosset, P. M. 2006. *Food is Different*. New York: Zed Books.; also see ActionAid International. 2012. *Asia at the Crossroads: Prioritising Conventional Farming or Sustainable Agriculture?* Johannesburg: ActionAid International. Available at: http://www.actionaid.org/sites/files/actionaid/asia_at_the_crossroads_full_report_2012.pdf.
[21] Setboonsarng, S. 2006. 'Organic Agriculture, Poverty Reduction, and the Millennium Development Goals'. *ADB Institute Discussion Paper No. 54.* Cited in ActionAid International. 2012. *Asia at the Crossroads: Prioritising Conventional Farming or Sustainable Agriculture?* Available at: http://www.actionaid.org/sites/files/actionaid/asia_at_the_crossroads_full_report_2012.pdf
[22] United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 2009. *Sustainable Agriculture and Food Security in Asia and the Pacific.* Bangkok: UNESCAP, p. 39. Available at: http://www.unescap.org/65/documents/Theme-Study/st-escap-2535.pdf.
[23] UNESCAP. 2005. *State of the Environment in Asia and the Pacific 2005*. Bangkok: UNESCAP. Cited in ActionAid International. 2012. Asia at the Crossroads: Prioritising Conventional Farming or Sustainable Agriculture?. Johannesburg: ActionAid International.
[24] Rosset, P. et al. 2000. 'Lessons from the Green Revolution'. Available at: http://www.foodfirst.org/media/opeds/2000/4-greenrev.html.
[25] UNESCAP. 2009. Sustainable Agriculture and Food Security in Asia and the Pacific. Bangkok: UNESCAP, p. 60.
[26] Hazell, P. 2009. 'The Asian Green Revolution', *IFPRI Discussion Paper*, November, p. 9.
[27] Hazell, P. 2009. 'The Asian Green Revolution', *IFPRI Discussion Paper*, November, p. 7.
[28] FAO. 2011. *The State of Food Insecurity in the World 2011.* Rome: FAO, p. 46.
[29] Setboonsarng, S. 2006. 'Organic Agriculture, Poverty Reduction and the Millennium Development Goals', *ADB Institute Discussion Paper No. 54*, p. 5.
[30] UNESCAP. 2009. *Sustainable Agriculture and Food Security in Asia and the Pacific*. Bangkok: UNESCAP, p. 8.
[31] A 1995 study by Freebairn. Cited in Hazell, P. 2009. 'The Asian Green Revolution', *IFPRI Discussion Paper*, November, p. 11.
[32] Pesticide Action Network Asia Pacific (PAN-AP). 2010. 'Communities in Peril: Global report on health impacts of pesticide use in agriculture'. Penang: PAN-AP. Available at: http://www.pan-germany.org/download/PAN-I_CBM-Global-Report_1006-final.pdf.
[33] Ibid.
[34] WWF-UK. 2011. *Soya and the Cerrado: Brazil's forgotten jewel*. Surrey: WWF UK. Available at: http://assets.wwf.org.uk/downloads/soya_and_the_cerrado.pdf.
[35] Smith, P. D. et al. 2007. 'Agriculture'. In B. Metz et al. (eds). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, Section 8.4.3.
[36] De Schutter, O. 2011. 'Agroecology and the Right to Food'. Report presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49]. Available at: http://www.srfood.org/images/stories/pdf/officialreports/20110308_a-hrc-16-49_agroecology_en.pdf.
[37] Hoffmann, U. 2010. 'Assuring food security in developing countries under the challenges of climate change: Key trade and development issues of a profound transformation of agriculture'.

Discussion Paper No. 201, November. Geneva: UNCTAD, pp. 11. Cited in De Schutter, O. 2011. 'Agroecology and the Right to Food', Report presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49].
[38] De Schutter, O. 2011. 'Agroecology and the Right to Food', Report presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49].
[39] Pesticide Action Network North America (PANNA). 2009. 'Agroecology and Sustainable Development: findings from the UN-led International Assessment of Agricultural Knowledge, Science and Technology for Development'. San Francisco: PANNA. Available at: www.panna.org/sites/default/files/AgroecoBriefFINALsmall.pdf.
[40] Ibid.
[41] UNFCC. n.d. 'International response to climate change', Climate Change Information Sheet 17. Available at: http://unfccc.int/essential_background/background_publications_htmlpdf/climate_change_information_kit/items/300.php.
[42] Ibid.
[43] Directgov. n.d. 'A history of climate change'. Available at: www.direct.gov.uk/en/Environmentandgreenerliving/Thewiderenvironment/Climatechange/DG_072901.
[44] FAO. 2000. 'Two Essays on Climate Change and Agriculture'. *Economic and Social Development Paper*. Rome: FAO. Available at: http://www.fao.org/DOCREP/003/X8044E/X8044E00.HTM.
[45] Stern, N. 2006. 'Summary of Conclusions. Stern Review: The Economics of Climate Change.'. Available at: http://www.hm-treasury.gov.uk/d/CLOSED_SHORT_executive_summary.pdf.
[46] Ibid.
[47] IPCC. 2007. "3.5. Interaction between mitigation and adaptation, in the light of climate change impacts and decision-making under long-term uncertainty" In B. Metz et al. (Eds). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press. Available at: http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch3s3-5.html.
[48] University of Greenwich Natural Resources Institute (NRI). 2010. 'Climate Change, Agricultural Adaptation and Fairtrade: Identifying the Challenges and Opportunities'. NRI Working Paper Series: Climate Change, Agriculture and Natural Resources. No. 1. Greenwich: University of Greenwich. Available at: http://www.nri.org/docs/d4679-10_ftf_climate_agri_web.pdf.
[49] Institute of Development Studies (IDS) & Tearfund. 2006. Adapting to climate change: Challenges and opportunities for the development community. London: Tearfund, p. 6. Available at: http://www.tearfund.org/webdocs/website/Campaigning/policy%20and%20research/Adapting%20to%20climate%20change%20discussion%20paper.pdf.
[50] United Nations Framework Convention on Climate Change (UNFCC). 2007. *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries*. Bonn: UNFCC. Available at: http://unfccc.int/resource/docs/publications/impacts.pdf.
[51] Perry, M. et al. 'Assessing the costs and adaptation to climate change: A review of the UNFCC and other recent estimates'. London: Imperial college Grantham Institute for Climate Change & IIED. Available at: http://pubs.iied.org/pdfs/11501IIED.pdf.
[52] World Bank. 2010. 'The Costs of Agricultural Adaptation to Climate Change'. *Discussion Paper Number 4*, August. Available at: http://siteresources.worldbank.org/EXTCC/Resources/407863-1229101582229/D&CCDP_4-Agriculture9-15-10.pdf.; Nelson, G. et al. 2009. 'Climate Change: Impact on Agriculture and Costs of Adaptation'. Washington, D.C.: International Food Policy Research Institute (IFPRI). Available at: http://www.ifpri.org/sites/default/files/publications/pr21.pdf.
[53] Perry, M. et al. 'Assessing the costs and adaptation to climate change: A review of the UNFCC and other recent estimates'. London: Imperial College Grantham Institute for Climate Change & IIED.
[54] OECD/FAO. 2010. *Agricultural Outlook 2010-2019*. Paris: OECD, p. 6. Available at: http://www.agri-outlook.org/dataoecd/13/13/45438527.pdf.
[55] Peskett, L. et al. 2007. 'Biofuels, Agriculture, and Poverty Reduction'. *Natural Resource Perspectives,* 107. London : Overseas Development Institute (ODI), p. 5. Avalable at: http://www.odi.org.uk/resources/docs/100.pdf.
[56] FAO. 2009. 'Coping with a changing climate: considerations for adaptation and mitigation in agriculture'. *Environment and Natural Resources Management Series*, 15. Rome: FAO, p. 56. Available at: http://www.fao.org/docrep/012/i1315e/i1315e.pdf.
[57] Bowyer, C. 2010. 'Anticipated Indirect Land Use Change Associated with Expanded Use of Biofuels and Bioloquids in the EU - An Analysis of the National Renewable Energy Action Plans'. Brussels: Institute for European Environmental Policy (IEEP).
[58] ActionAid, BirdLifeEurope, ClientEarth, Transport & Environment, FERN, Wetlands International, Friends of the Earth Europe, Greenpeace, and European Environmental Bureau. 2010. 'Driving to Destruction: The impacts of Europe's biofuel plans on carbon emissions and land'. Available at: http://www.actionaid.org.uk/doc_lib/driving_to_destruction.pdf.
[59] Mortimer, N. D. 2011. 'Life cycle analysis of refined vegetable oil and biodiesel from jatropha grown in Dakatcha Woodlands of Kenya'. Northumberland: North Energy Associates Limited. Available at: http://www.actionaid.org.uk/doc_lib/kenyan_jatropha_final_report.pdf.; ActionAid International. 2011. 'Fueling Evictions: Community Costs of EU Biofuel Boom'. Johannesburg: ActionAid International, p. 5. Available at: http://www.actionaid.org.uk/doc_lib/aa_dakatcha_report.pdf.
[60] ActionAid Brazil. 2010. *Smoke Screen: The Hidden Story Behind Biofuel Production*. Rio de Janeiro: ActionAid Brazil, p. 18. Available at: http://www.actionaid.org/publications/smoke-screen-hidden-story-behind-biofuel-production.
[61] Ibid.
[62] Loewenson, R. 2000. 'Occupational safety and health for women workers in agriculture: Public health issues in the agricultural sector call for specific technical inputs and for addressing the issues of deprivation and imbalances of power'. In ILO. 2000. *Top on the agenda: Health and safety in agriculture.* Labour Education 2000/1-2 Nos. 118/11, p. 35-45.
[63] ActionAid. 2011. Fuelling Evictions: Community Cost of EU Biofuels Boom. Dakatcha Woodlands, Kenya. Brussels: ActionAid EU Office.
[64] A study by DIEESE (Inter-Union Department of Statistics and Socio-Economic Studies in Brazil) on working conditions at the sugar cane plantations in Paraíba concluded that workers suffer enormous losses due to the following practices: daily wage and minimum salary reduction; the raising of fees through classification of irregular cane; errors or fraud in the way the cane harvest is measured; and commutation or non-payment based on agreements such as paid rest, vacations, or the customary extra-month bonus at the end of the year. For details, see: ActionAid Brazil. 2010. *Smoke Screen: The Hidden Story Behind Biofuel Production.* Rio de Janeiro: Brazil.
[65] ActionAid Brazil. 2010. *Smoke Screen: The Hidden Story Behind Biofuel Production.* Rio de Janeiro: Brazil.
[66] Anseeuw, W. et al. 'Land Rights and the Rush for Land: Findings of the Global Commercial Pressures on Land Research Project'. Rome: International Land Coalition (ILC). Available at: http://www.landcoalition.org/sites/default/files/publication/1205/ILC%20GSR%20report_ENG.pdf.
[67] Robbins, M. 2004. *Carbon Trading, Agriculture and Poverty*. *World Association of Soil and Water Conservation (WASWC) Special Publication No. 2.* Beijing: WASWC.
[68] Lal, R. 2009 'Agriculture and Climate Change: An Agenda for Negotiation in Copenhagen. The Potential for Soil Carbon Sequestration'. *IFPRI Focus 16, Brief 5, May*. Available at: http://www.ifpri.org/sites/default/files/publications/focus16_05.pdf.
[69] Ibid, p. viii.
[70] EcoSecurities. 2007. 'Policy Brief: REDD Policy Scenarios and Carbon Markets'. Oxford: EcoSecurities. Available at: http://www.ecosecurities.com/Assets/23864/pubs%20-%20redd%20policy%20brief%20ecosecurities%20(background%20version)_je%20v1.pdf; ClimateChangeCorp. 2012. 'The global carbon market explained', 21 Mar. Available at:

http://www.climatechangecorp.com/content.asp?ContentID=4814; ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p. 3-4.
[71] ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p.4.
[72] IPCC. 2007. *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC, p. 104. Available at: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.
[73] Glantz, M. H. & Gommes, R. 2009. 'Coping with a changing climate: Considerations for adaptation and mitigation in agriculture'. *Natural Resources Management Series,* 15. Rome: FAO., p. 42. Available at: http://www.fao.org/docrep/012/i1315e/i1315e.pdf.
[74] ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p, 5. Available at: http://www.actionaid.org/sites/files/actionaid/actionaid_briefing-fiddling_with_soil_carbon_markets_0.pdf.
[75] Ibid.
[76] Ibid.
[77] Robbins, M. 2004. *Carbon Trading, Agriculture and Poverty*. *World Association of Soil and Water Conservation (WASWC) Special Publication No. 2.* Beijing: WASWC.
[78] Ibid.
[79]ActionAid International. 2011. 'Say No to Soil Carbon Markets! Six reasons why soil carbon markets won't work for smallholders'. Johannesburg: ActionAid International.; Suppan, S. & Sharma, S. 2011. 'Elusive Promises of the Kenya Agricultural Carbon Project', Minneapolis: Institute for Agriculture and Trade Policy (IATP). Available at: http://www.iatp.org/documents/elusive-promises-of-the-kenya-agricultural-carbon-project.; IATP. African Biodiversity Network & The Gaia Foundation. 2011. 'Soil Carbon Sequestration for Carbon Markets: The Wrong Approach to Agriculture'. Available at: http://www.iatp.org/files/soil_carbon_durban12-5-11.pdf.
[80] See 'Box 2: The Kenya Agricultural Carbon Project' in ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p, 8.
[81] Ibid, p. 7,
[82] Ibid.
[83] Tschakert, Petra (2004) Carbon for farmers: assessing the potential for soil carbon sequestration in the Old Peanut Basin of Senegal. *Climatic Change* 67: 273-290.
[84] Ibid, p. 8.
[85] Toulmin, C. 2011. 'Prospering despite climate change'. Paper presented at the IFAD Conference on New Directions for Smallholder Agriculture, 24-25 January. Available at: http://www.ifad.org/events/agriculture/doc/papers/toulmin.pdf.
[86] ActionAid (2011) "Say No to Soil Carbon Markets! Six reasons why soil carbon markets won't work for smallholders." International Briefing. p 5
[87] ActionAid International. 2011. 'Say No to Soil Carbon Markets! Six reasons why soil carbon markets won't work for smallholders'. Johannesburg: ActionAid International.
[88] ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p, 5.
[89] Ibid.
[90] IAASTD (2009) *Agriculture at the crossroads*, by B.D. McIntyre, H.R. Herren, J. Wakhungu & R.T. Watson, eds. Washington, DC.
[91] FAO. 2011. *Save and Grow*. Rome: FAO. The World Bank's 2008 World Development Report and the UK government's 2011 Foresight Report have also called for a shift from current farming practices to sustainable agriculture systems capable of providing both significant productivity increases and enhanced ecosystem services.
[92] World Bank. 2011. 'Climate-Smart Agriculture: A Call to Action'. Washington, D.C.: World Bank.
[93] World Bank. 2011. 'Climate-Smart Agriculture: A Call to Action'. Washington, D.C.: World Bank, p. 4.
[94] http://www.fao.org/climatechange/29723-0c174581f92a9d71a125c30981e7b42fb.pdf
[95] The Munden Project. 2011. 'REDD and Forest Carbon: market-based critique and recommendations'. New York: The Munden Project. Cited in ActionAid International. 2011. *Fiddling With Soil Carbon Markets While Africa Burns*... Johannesburg: ActionAid International, p, 10.
[96] REDD is a partnership between FAO, UNDP and UNEP and was launched in September 2008. REDD programs aim to reduce greenhouse gas emissions by preventing deforestation and forest degradation. The REDD+ includes provisions to reduce emissions from the conservation and sustainable management of forests and enhancement of forest carbon stocks.
[97] Friends of the Earth International. 2010. REDD: The realities in black and white. Amsterdam: FoEI. Available at: http://www.foei.org/en/resources/publications/pdfs/2010/redd-the-realities-in-black-and-white.
[98] Ibid.
[99] World Bank. 2011. 'Opportunities and Challenges for Climate-Smart Agriculture in Africa' *Policy Brief.* Washington, D.C.: World Bank, p. 3. Available at: http://climatechange.worldbank.org/sites/default/files/documents/CSA_Policy_Brief_web.pdf.
[100] ETC Group. 2010. 'Gene Giants Stockpile Patents on "Climate-ready" Crops in Bid to become "Biomassters"'. *Issue # 106*. Available at: http://www.etcgroup.org/upload/publication/pdf_file/FINAL_climate-readyComm_106_2010.pdf.
[101] UN Women Watch. 2009. 'Fact Sheet: Women, Gender Equality and Climate Change'. Available at: http://www.un.org/womenwatch/feature/climate_change/downloads/Women_and_Climate_Change_Factsheet.pdf.
[102] Pretty, J. 2006. 'Agroecological Approaches to Agricultural Development'. A document in preparation of the *World Development Report 2008, Agriculture for Development.* Available at: http://www.rimisp.org/getdoc.php?docid=6440.
[103] Alteiri, M. A. & Koohafkan, P. 2008. *Enduring Farms*. Kuala lumpur, Malaysia: Third World Network.
[104] FAO. 2011. *The State of Food and Agriculture 2010-11. Women in Agriculture: Closing the gender gap for development*. Rome: FAO.
[105] Lopes, A. P. & Jomalinis, E. 2011. 'Agroecology: Exploring opportunities for women's empowerment based on experiences from Brazil'. *Feminist Perspectives Towards Transforming Economic Power.* Toronto, Mexico City, Cape Town: Association of Women's Rights in Development (AWID). Available at: http://www.awid.org/content/download/135069/1504813/file/FPTTEC_Agroecology_ENG.pdf
[106] 'Case Study: Role of Green Manure Crops in Lowland Rice Based Farming System of Northern Thailand'. Available at: http://www.agroecology.org/Case%20Studies/greenmanure.html
[107] Bates, B. et al. (eds). 2008. 'Climate Change and Water'. *Technical Paper of the Intergovernmental Panel on Climate Change*. Geneva: IPCC Secretariat. Available at: http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf.
[108] Ibid.
[109] Ojwang, G. O. et al. 2010. 'Analysis of Climate Change and Variability Risks in the Smallholder Sector: Case studies of the Laikipia and Narok Districts representing major agro-ecological zones in Kenya'. *Environment and Natural Resources Management Working Paper*, 41. Rome: FAO.
[110] United Nations Environment Programme (UNEP). 2009. *Rainwater harvesting: a lifeline for human well-being. A report prepared for UNEP by Stockholm Environment Institute*. New York: UNEP. Available at: http://www.unep.org/Themes/Freshwater/PDF/Rainwater_Harvesting_090310b.pdf.
[111] See the Case study on One Million Cisterns by the Brazilian Semi-Arid Region Alliance (ASA), in: ActionAid International. 2008. *The Time is NOW: Lessons from farmers adapting to climate change*. Johannesburg: ActionAid International.
[112] For details, see: ActionAid International. 2008. *The time is NOW: Lessons from farmers adapting to climate change*. Johannesburg: ActionAid International.

[113] Platform for Agrobiodiversity Research. 2010. 'The use of agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change, Synthesis Paper'. Rome: Biodiversity International, Christensen Fund.
[114] Clawson, D. L. 1985. 'Harvest Security and Intraspecific Diversity in Traditional Tropical Agriculture'. *Economic Botany*, 39: p. 56-67.
[115] Jordan, C. F. 2011. 'Genetic Engineering, the Farm Crisis and World Hunger'. *BioScience*, 52: p. 523-29.
[116] De Schutter, O. 2011. 'Agroecology and the Right to Food', Report presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49], Citing Platform for Agrobiodiversity Research. 2010. 'The use of agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change, Synthesis Paper'. Rome: Biodiversity International, Christensen Fund.
[117] Francis, C. A. 1986. *Multiple Cropping Systems*. New York: McMillan, Cited in Altieri, M. A. 2009. 'Agroecology, Small Farms, and Food Sovereignty'. *Monthly Review*, 61 (3).
[118] Rosset, P. 1999. 'Small is Bountiful'. *The Ecologist*, 29, Cited in Altieri, M. A. 2009. 'Agroecology, Small Farms, and Food Sovereignty'. *Monthly Review*, 61 (3).
[119] De Schutter, O. 2011. 'Towards more equitable value chains: alternative business models in support of the right to food', Report presented at the 66th Session of the United Nations General Assembly [A/66/262]
[120] Minot, N. & Hill, R. V. 2007. 'Developing and Connecting Markets for Poor Farmers'. *2020 FOCUS BRIEF on the World's Poor and Hungry People,* October. Washington, D. C.: IFPRI.
[121] Ibid.
[122] ActionAid International, et al. 2012. 'What Works for Women: Proven approaches for empowering women smallholders and achieving food security'. A multi-agency backgrounder. Available at: http://www.actionaid.org/sites/files/actionaid/what_works_for_women_-_final.pdf.
123[123] L. Bachmann et al. (eds.) 2009. *Food Security and Farmer Empowerment, MASIPAG*. Los Baños: Philippines. Cited in De Schutter, O. 2011. 'Towards more equitable value chains: alternative business models in support of the right to food', Report presented at the 66th Session of the United Nations General Assembly [A/66/262]

ActionAid is an international anti-poverty agency working in over 40 countries, taking sides with poor people to end poverty and injustice together.

ActionAid
International Secretariat
4th Floor, The Mall Offices
11 Cradock Avenue
Rosebank 2196
Johannesburg
South Africa

Telephone: +27-11-731450
Facsimile: +27 11 880 8082
Email: mail.jhb@actionaid.org
www.actionaid.org

ActionAid International is incorporated in The Hague, The Netherlands. Registration number 2726419
ActionAid International is incorporated in South Africa under section 21A of the Companies Act 1973. Registration Number 2004/007117/10