

AT ISSUE

More Ominous than Climate Change? Global Policy Threats to African Food Production

ANDREW MUSHITA AND CAROL THOMPSON

Abstract: In international fora, climate change discussions center on how farmers can “mitigate” and “adapt” to weather variability to increase food production. Instead, African smallholder food producers are employing ways to “resist” and “sustain,” for international policies in the name of climate change threaten their farming systems, biodiverse genetic wealth, and their indigenous knowledge. These policy storms could be more devastating than any weather variability, for they could destroy the very resources that farmers use to produce biodiverse foods: their seeds, land, soil, water, and markets. This article first focuses on analysis of the policy changes that mirror the climate hazards: drought, floods, rising temperatures, and weather variability. Second, we discuss African alternatives, the ways in which smallholder farmers are resisting outside agendas to transform their farming systems and sustaining their resilient food production.

The crises of climate change are commanding policy agendas for African food and agriculture. Dire predictions abound about increasing drought and temperatures reducing food crop yields and livestock quantity and quality: Africa will become even hungrier. Although the continent of Africa is not the source of greenhouse gas (GHG) emissions (responsible for only 3.7 percent of global total), the orientation of the discussions and debates centers on how farmers can “adapt” and “mitigate” climate change in order to increase food production. The well-financed international agenda emphasizes promotion of carbon sinks for mitigation and new technology such as “climate ready seeds” for adaptation. Instead, the discussions ought to focus on the dire need to significantly reduce greenhouse gas emissions by developed countries. Setting out a threshold for GHG emissions reduction processes and levels that are time bound and formulating enforceable mechanisms and related global penalties for any defaulter is fundamental to addressing the climate change challenges.

Based on two decades of work with smallholder farmers in Southern Africa, and recent scientific research among them about climate change, this article suggests another way forward for Africa.¹ Instead of “adapting” and “mitigating,” smallholder food producers are employing ways to “resist” and “sustain,” for policies coming from the North in the name of

Andrew Mushita is an agronomist and Director of the Community Technology Development Trust (CTDT) in Zimbabwe. He founded CTDT to support networks of smallholder farmers across Southern Africa.

Carol Thompson is a political economist and Professor of Politics and International Affairs, Northern Arizona University who works in the field of international environmental policies and African food production.

<http://www.africa.ufl.edu/asq/v13/v13i4a1.pdf>

climate change threaten smallholders' farming systems, biodiverse genetic wealth, and their indigenous knowledge. These policy storms could be more devastating and extensive than any temperature or rain variability, for they could destroy the very resources that farmers use to produce biodiverse foods: their seeds, land, soil, water, and farming systems. Even a firestorm leaves seeds deep in the ground to germinate, but many current international policies involve replacing, not rejuvenating, African smallholder food production systems—much worse than a firestorm.

Only giving a brief reminder of climate change predictions for Africa, this article focuses first on analysis of the policy changes that mirror the climate hazards: drought, floods, rising temperatures, and weather variability. Some of the policies evolve directly from climate change strategies, while others reflect more macro-economic policies, but ones that affect food research, production, and marketing. Second, the paper discusses African alternatives, the ways in which smallholder farmers are sustaining their biodiverse food production and resisting outside agendas to transform their farming systems.² African alternatives suggest lessons for smallholders in other regions to advance their farming systems during this crisis of climate change. These African food production practices are designed to deflect pressure on continued global food price increases that are likely to spiral since they are exacerbated by volatile global market dynamics, inadequate global coordination, and the multiple effects of climate change, energy shortages, water scarcity, land degradation, and accelerated agricultural biodiversity loss.

Drought

Climate change is spreading the extent and severity of droughts, and the African continent is predicted to be the most affected.³ Areas already semi-arid will become deserts, and current rain-fed arable land will need irrigation from diminishing streams and lakes. Although Southern Africa records are not yet showing reduction in average annual rainfall, increased variability of rains already affects yields. The pattern seems to be shifting with rains arriving several weeks late, and the usual mid-season dry spell increasing from two or three weeks to about six weeks. Farmers are sustaining their food production by planting highly diverse crops (fifteen to twenty on one hectare) at different times, some very late, and they are intensifying techniques of water harvesting. Locally cultivated open pollinated varieties (OPVs) of maize are more tolerant of extended dry spells than the hybrids, but farmers are also turning more to sorghums and millets, both more drought tolerant than maize.⁴ Crop diversification is key and central to sustaining crop productivity, containing rainfall variability, and ensuring food sovereignty.

The policy drought, however, is already severe. A review of “world economic prospects” from UN-DESA and UNCTAD reports a net outflow of capital from Africa to developed economies from 2000-2010, calling it a “pattern in which poor countries transfer significant resources to much richer nations”⁵ Further, although minerals have gained in global market prices, the terms of trade for agricultural commodities continue to deteriorate over the long term.⁶ A prominent scholar, John Weeks, suggests that the extent of capital outflow demonstrates that “sub-Saharan Africa, location of the poorest countries in the world, has generated net capital outflows for decades. One could with small exaggeration say that for a generation Africa has provided aid to the United States and Western Europe.”⁷

A 2010 study, revealing one stark example of capital outflows from Africa, reported the magnitude of “illicit” capital removals at about \$30 billion per year or twice the African

foreign debt.⁸ In comparison, all official development assistance (ODA) to agriculture for all of Africa averages only about \$2 billion per year.⁹ Despite the onset of the global financial crisis, the updated study (2011) found that illicit flows from sub-Saharan Africa increased 15.7 percent in real terms in 2009.¹⁰

The category of “illicit” financial flows refers to tax havens, secrecy jurisdictions, disguised corporations, anonymous trust accounts, fake foundations, trade transfer pricing, and money laundering techniques.¹¹ In contrast to what might be expected, those removing the capital are estimated as follows:

TABLE 1: ESTIMATED CONTRIBUTION TO ILLICIT CAPITAL OUTFLOW FROM AFRICA

Source	Percent of Total
Corruption of Government Officials	~ 3
Criminal (counterfeiting, etc.)	30-35
Corporate Tax Evasion	60-65

Note: tabulated from Kar and Cartwright Smith 2010, p. 1.

The study concludes with an explanation and a recommendation:

It is not surprising why donor-driven efforts to spur economic development and reduce poverty have been underachieving in Africa.... Policy measures must be taken to address the factors underlying illicit outflows. In addition, African countries must impress upon the G-20 the need for better transparency and tighter oversight of international banks and offshore financial centers that absorb these flows.¹²

Other studies, including from the International Monetary Fund, are beginning to debate how capital controls could best be implemented and enforced.¹³

Directly related to agriculture is another financial drought: very little benefit sharing back to smallholder farmers for the genetic resource wealth they have freely shared. Although the Convention on Biological Diversity (UN-CBD 1993) and the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO 2004 - ITPGRFA) both require benefit sharing back to the farmers, it is not yet forthcoming. The CGIAR centers (Consultative Group on International Agricultural Research) hold about 696,000 accessions (seed samples), overwhelmingly donated by South country farmers, in trust for humankind. Under the ITPGRFA, the standard material transfer agreement (SMTA) is the instrument to enforce the prohibition on patenting of any of the treaty-protected varieties (only sixty-nine) and to request benefit sharing (0.7 percent of profit) for any materials providing commercial benefits of all the varieties. This access and benefit sharing (ABS) facilitates retaining the accessions in the public domain while providing funding for their maintenance and distribution. ABS provisions, inspired by the CBD and the ITPGRFA and influenced by international and national social, economic, and political factors, include: ownership; scope; access procedure; prior informed consent; benefit sharing and compensation mechanisms; intellectual property rights and the protection of traditional knowledge; in-situ biodiversity conservation and sustainable use; and enforcement and monitoring. All these elements have to be addressed within a national ABS legislative framework as ownership of genetic resources determines access conditions, procedures, rules, and rights over these resources.

ABS is, by definition, a blend of two concepts that are politically and legally linked. The concepts are merged for convenience and practical purposes as ABS, but there are many ways in which they are best understood separately.¹⁴ In the Convention on Biological Diversity, the term “access to genetic resources” refers to the ability of a country, its subjects, or representatives to obtain the right to sample, study or use particular specimens of genetic material. On the other hand, the term “fair and equitable sharing of the benefits” refers to the right of holders of such genetic resources to benefit from their utilization, including commercial utilization. For this purpose, the broad concepts of ABS include numerous other issues such as transfer of technology and ownership and intellectual property issues arising from traditional knowledge associated with the accessed genetic resources.¹⁵ The concept has since been given international legal prominence through the ABS Protocol that was adopted by member states of the CBD during the tenth Conference of Parties Meeting (COOP 10) held in Nagoya, Japan in November 2010.

A critical issue related to ABS, as highlighted above, is the protection of traditional knowledge associated with genetic resources. Article 8j of the CBD calls upon Member States to “respect, preserve and maintain knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity.” Communities, especially those in developing countries, have played a major role in the conservation of biological diversity through the use of indigenous knowledge systems (IKS). However, there is a growing realization amongst these communities that the genetic resources they are conserving and the traditional knowledge they possess associated with these resources are being exploited to their disadvantage. This realization has the potential of acting as a disincentive for them to continue their customary role of conservation, as evidenced by developments in modern biotechnology and by the continued expansion of global trade that especially have allowed developed countries to gain greater access to, and to derive benefits from, the world’s biological and genetic resources. Farmers ought to be rewarded for their past, present, and future contributions to the conservation and sustainable use of genetic resources. In this case, there is a need to domesticate and implement people-centered ABS regulatory frameworks that provide meaningful incentives: affirmation of rights to farmers, monetary and non-monetary benefits, access to technology, and support for the preservation of local indigenous knowledge systems.

Though access is open to anyone, the benefit sharing, based on voluntary accountability, fails to bring in funds or recognition of the genetic wealth cultivated by indigenous farmers. The policy in principle has been accepted across the globe, but the failure of implementation perpetuates, or actually facilitates, biopiracy of indigenous knowledge and seed from smallholder farmers.

The inability to access technology is another type of policy “drought.” Because of the biotechnology race to privatize “intellectual property” over the last two decades, innovations are slow to enter the public domain and when they are available for scrutiny or use, it is only after paying royalties. Not only the end product remains a “trade secret” for years, but also, the process used to achieve that innovation, making the phrase “technological transfer” an anachronism. Large economies like the People’s Republic of China or India may ignore many intellectual property rights (IPRs) and not be prosecuted, but smaller countries in Africa cannot afford such risks. Quite the opposite, when one of

their plants or animals is cross-bred and patented, an African country often cannot afford to sue the perpetrator because of millions of dollars in litigation costs.¹⁶

The policy droughts of the inability to earn revenue via material transfer agreements for their seeds and of insufficient access to biotechnology are striking smallholder farmers much more severely than dry spells of the variable rains. UN agencies are noticing the problem and advocating more effective means to share resources than the SMTAs. Calling for more sharing of power, not just benefits, related to the allocation of resources, the FAO Commission on Genetic Resources for Food and Agriculture points out that less sharing results in less adoption:

Even when there has been strong development of biotechnologies within the public sector in developing countries, they have not always been directed towards—or made available for—improving smallholder livelihoods. In fact, an inclusive process of decision-making about the allocation of resources for the development of appropriate crop biotechnologies was rarely adopted, undermining the successful development of crop biotechnologies¹⁷

UN-DESA names the problem and calls for initiatives through compulsory licencing, in order to release the sharing of resources:

... a small group of private companies is actively patenting plant genes with a view to owning the rights to the genes' possible "climate readiness" in the future. ...Where exclusive private-sector rights of use to vital technology are a hindrance to the development of other needed technology or to widespread use, the technology regime must have a mechanism (such as exists in certain areas of public health) for granting a "compulsory licence" that places said technology in the public domain.¹⁸

The net flow of capital removed from the African continent, the decline in official aid for African agriculture, voluntary payments for material transfer agreements for African genetic wealth not honored, and proprietary rights reducing transfer of biotechnology are just a few examples of the "policy droughts" which constrain smallholder food production. As the precipitation becomes even less from climate change, African food producers will have already been rendered more vulnerable by these financial and technological transfer "droughts."

Floods

Predictions of rainfall changes in Africa vary with the region: "...increases in equatorial Africa, decreases in the Sahel and Southern Africa, and more variability in [East] Africa. These changes will be accompanied by an increase in extreme events (floods and droughts) and sea level rise of some 20 to 50 centimeters by 2050, particularly in West Africa."¹⁹ Floods are occurring across Southern Africa in places never before known to have too much water. More than drought, the waters wipe out not only the crops and livestock but infrastructure and equipment to rejuvenate for the next season. Zambia in 2010 experienced a serious epidemic of measles that quickly spread because health officials could not reach communities isolated by heavy rains for either immunization or cure. The health effects of flooding can be very serious, and increasing flood waters from climate change will disrupt food production, transport, and health care.²⁰ In addition, vulnerability to environmental change not only depends on change in frequency or duration of climate conditions, but also on the capacity to respond adequately to those changes by the affected communities.

Household income, income diversification, availability of labor, and the health status of household members are factors that determine vulnerability. The other key elements for resilience against the effects of climate change are the depth of local knowledge systems related to food production, ecological farming practices, and crop diversification that can be used as a risk aversion measure.

An example of a “policy deluge” is most aptly illustrated by the multiple introductions of genetically modified organisms (GMOs), even in countries that practice the precautionary principle for their testing, propagation, and use (e.g., Zambia, Zimbabwe). Since the infusion of genetically modified (GM) grain as food aid into Southern Africa in 2002, GMO contamination threatens local varieties of maize and soya. A highly financed drive for “mitigation” of climate change promotes adaptation of GM seeds for maize, soya, cassava, and sorghums, as “climate-ready seeds.” This campaign arrives in the form of grants to scientists, aid to governments, subsidized seeds to farmers, and through marketing. The policy flood washes over research grants, loans, rural credit, subsidies, food aid, and throughout the markets. Climate change becomes the urgent reason for this adaptation, promoted by many initiatives from the Millennium Challenge Corporation, the Alliance for a Green Revolution in Africa (AGRA) to the Africa Union’s Comprehensive Africa Agriculture Development Program (CAADP).

The latest entry point for the GM “floods” are agrofuels, for crops like jatropha are not really cost effective to produce biodiesel, unless more oil can be extracted from the seeds, the reason for genetically modifying jatropha.²¹ The chart below summarizes the most important GMO agendas for agrofuels:

TABLE 2: DELUGE OF GMOS - “SECOND GENERATION” AGROFUELS

Crop	Reasons for genetic modification
Cassava	>starch, >viral resistance
Cotton seed	>oil,>pest resistance
Groundnuts	>viral, fungal resistance
Maize	>starch
Sorghum	>starch, >viral, fungal resistance
Jatropha	>oil

Note: Steinbrecher 2008.

Only jatropha is not a food crop, and therefore, genetic contamination of locally-bred (cotton seed, groundnuts, maize) and of indigenous (cassava, sorghum) varieties threatens African food sovereignty and the genetic wealth of smallholder farmers to sustain food production during climate change. The flood of GM seeds, overflowing from many sources, renders the farmers more vulnerable to flood waters of climate change.

The origin of another “flood” into Africa is the globally marketed processed and fast foods. Given that highly refined wheat flour, white potatoes and fried foods do not begin to compete with African sorghum and millets for either nutrition or climate adaptability, one would expect to find these versatile indigenous food crops dominating the prepared foods sectors—in rural tuck shops, cafes, and urban restaurants, hotels—served as breads, snacks, drinks, and as the basic carbohydrate instead of wheat or potatoes. However, from fast food chains to remote rural shops, the foods offered are crisps, white bread, and Coke. Local

foods are not yet lost, for one can buy the flours and products in urban grocery stores, but the flood of globally marketed fast foods has already surged through the prepared foods markets at great profit.²²

Turning away from a traditional diet, most urban and rural African teenagers do fancy chips and Coke as much as blue jeans. The HIV/AIDS pandemic, however, highlights the importance of nutritious food, for persons living with HIV need considerably more protein and nutrients than the average, for they keep the body's immune system active.²³

Traditional African foods are much more nutritious than globally marketed "fast food" fats, sugars, and salt. For example, as rich as maize for carbohydrates and vitamin B6, sorghum is more nutritious in protein, calcium, copper, iron, phosphorus, ash, pantothenic acid (vitamin B5), isoleucine and leucine (amino acids). Finger millet, traditionally cooked in delicious porridge for pregnant women, is also rich in the B vitamins, potassium, iron, phosphorous, magnesium and zinc. In Zimbabwe, nutrition gardens at rural health clinics are demonstrating how beneficial local foods are in enhancing nutrition for persons living with HIV. Further, these grains (e.g., sorghum, pearl millet, and finger millet) are highly drought tolerant because strains have been bred for early flowering to occur, not when adequate rains have come, but according to daylight length.

Rising Temperatures

Overall, sub-Sahara Africa registered 0.6 degrees Celsius increase in average temperatures, 1980-1990. The IPCC report predicts temperature rising three to four degrees Celsius for Africa, or 1.5 times the global mean.²⁴ Farmers affirm that 35 degrees Celsius is the maximum tolerated by maize, but the stress is more quickly expressed by cattle, and they quickly decline with rising temperatures, diminishing herd size. Although global warming is at the moment less a threat to farmers than drought, the "heat" or insistence from the North to adopt certain policies intensifies.

One policy intensely lobbied across the African continent is to privilege plant breeders' rights (PBRs) over farmers' rights (FRs) to seed. Strongly promulgated across the continent by WIPO (World Intellectual Property Office) in the drive to have governments accept UPOV (Union for the Protection of New Plant Varieties), plant breeders' rights honor scientists in laboratories, while refusing to recognize farmers as breeders. The 1991 UPOV treaty, in force since 1997, takes away farmers' rights to exchange, breed, and plant any seed and turns it into farmers' privilege (a request granted) to exchange seed. In contrast, the international plant treaty, under Article 9, (ITPGRFA), the first international law to recognize farmers' rights, tries to bring farmers' rights as breeders equal to plant breeders in laboratories. It recognizes farmers who have bred seeds for centuries, yet the differences between the two laws remain stark, as summarized in the Table Three below.

Because only two African governments (Kenya and South Africa) have accepted UPOV membership, policy pressure "heats up" for more African participation. But this law threatens food diversity, because PBRs enclose the plant genetic resources instead of sharing them with other breeders who experiment with new varieties, multiplying the genetic wealth for all. Further, industrial agriculture values very few strains of very few crops, promoting monoculture. Loss of genetic diversity results from decades of narrow genetic selection mainly focused on increased yields, minimising even vital nutrition traits.²⁵

TABLE 3: PLANT BREEDERS' VERSUS FARMERS' RIGHTS

Plant Breeders' Rights PBRs	Farmers' Rights FRs
Legal definition	Legal definition
Intellectual Property Rights	Recognition of indigenous knowledge
Patents of living organisms	Rejection of patents as biopiracy
Royalties	Benefit sharing not occurring
Public and private monitoring - national, international	No monitoring Africa: no government capacity
Access to public materials and funds	Access to public materials but no funds
Global market dominance deters alternatives	Africa: local market dominance by farmers' seeds but no entry into other markets
Genetic erosion	Sustaining biodiversity

Note: authors

During crises of climate change, it would appear that the international community would choose to value both FRs with PBRs, but quite the opposite is true, in terms of finance, legal authority, and prestige. As the chart above summarizes, farmers' rights are now defined in international law, but they have a much weaker traction in that benefit sharing back to the breeders is rare and international monitoring is ineffective, while plant breeders' rights offers access to seeds, effective monitoring, and royalty payments for trademarks and/or patents. The processes of realizing and domesticating the ITPRFA is not supported by the international community, neither in terms of providing technical or financial assistance, nor in formulating a model law that countries can adapt or adopt according to national interests and economic realities.

This disparity in recognition of two types of plant breeders illustrates how indigenous knowledge is disregarded in the global food chain. If climate change is such a crisis, then perhaps the global community should listen to and debate all kinds of knowledge from Cartesian ("Western") scientists to the practiced, successful cultivator who selects the best seeds and experiments in "field trials" every season. Indigenous knowledge sustains the vast array of African foods. So far, biotechnology is not even keeping up with Mother Nature, for the pests are evolving after three to four seasons of planting the GM crops (e.g., Monsanto Bt gene).²⁶ The response to this failure of GM is to try more GM, to pressure more for its use. At the least, the successes of indigenous knowledge should receive as much acclaim and financing as the failures of GMOs.

The two problems are coterminous: the devaluing of indigenous knowledge and the privatization of knowledge gained from laboratory experiments. Given the climate change crisis, policy directives might better serve the public interest by opening up the sharing of new ideas and partial answers, to find more answers and better ones, not to patent living organisms for a quick profit under the guise of climate change mitigation. The landmark report of the International Assessment of Agricultural Knowledge, Science and Technology (2009), engaging four hundred scientists over three years, recommends investment in the

kind of science that encourages participatory knowledge creation and the integration of indigenous knowledge.

In addition to the issues of plant breeders' rights over farmers' rights and of Cartesian science over indigenous knowledge, the use of African land for agrofuels is heating up as a policy demand. A World Bank study estimated that about 51 percent (29 of 56 million hectares) of the land designated of interest to foreign investors is in Africa, while the international non-governmental organization, GRAIN, found 446 cases of land grabbing of which 228 (56 percent) were in Africa.²⁷

Those accessing African land extend across the globe, including China, India, and the Persian Gulf countries. As is well known, it was a South Korea corporation (Daewoo Logistics) trying to lease half the arable land in Madagascar that destabilized the elected government in 2009. India is reportedly discussing investment of \$4 billion in Ethiopia, while Saudi Arabia is looking at 500,000 ha. China is trying to acquire access to as much as 2.8 million hectares in the Democratic Republic of the Congo and two million hectares in Zambia.²⁸ From 2010, China's State Development & Investment Corporation, in the China-Africa Development Fund, initiated discussions for ethanol production, based on sugarcane and manioc investment in several African countries, starting with Benin (about 5,000 ha) and Sierra Leone (10,000 ha).²⁹

The mix of who is doing what, however, is difficult to ascertain; for example, in Sierra Leone, a Vietnamese company began rice and rubber production in 2012, but with financing from China and from several European development banks (Sweden, Germany, the Netherlands, and Belgium).³⁰ The series of studies by the Oakland Institute document the wide range of interests, including Harvard and Vanderbilt Universities investing in UK hedge funds to lease African farmland. In Mozambique, the leasing is by Norway, Sweden, Portugal, Italy, the UK, and the US. Global Witness and the Oakland Institute's April 2012 report, however, documents how very difficult it is to learn who is leasing what from whom, for many of the contracts are now made in secret, given that some of the most egregious deals were annulled after civil society organizing, as in Tanzania and Mozambique.³¹

International pressure comes in the form of promised revenue for debt-ridden governments, along with a few jobs. However, agrofuel crops require large plantations, with plenty of water, fertilizer, and pesticides for high yields; harking back to the nineteenth century, plantation agriculture perpetuates all the negatives of industrial agriculture: fossil fuel dependence, ground water and air pollution, soil contamination, and repressive labor conditions. Further, the agrofuels will be less for local use and more for export overseas to the highest bidders.³² In the twenty-first century, can the international community really address climate change by continuing two centuries of exploitation of African lands for overseas consumption while Africans remain poor?

Weather Variability

In Southern Africa, the first expressions of climate change are coming in highly variable weather patterns. As stated above, overall average annual rainfall is about the same, but the rains come late and are sporadic to the point of withering young plants. Similarly, temperature variability is greater than before. "Average" conditions no longer exist, calling into question a farming system of monoculture over vast tracts of land. In contrast, smallholder farmers are planting according to microclimates within their fields, avoiding the genetic vulnerability of vast tracts of monoculture. In Southern Africa, the capacity to

manage such a variety of crops derives from participation in farmer field schools, many functioning for decades, where farmers share knowledge and experience while jointly solving specific problems arising each season; indigenous knowledge assists with indicators about weather (timing of tree flowering) that is as accurate, or more accurate, than meteorological data sent from overly centralized weather stations to remote areas.³³ Farmers' scientific data report the variability within microclimates.

One such "policy variability" paralleling weather variability is a much greater hazard in the short term: price volatility from the global financialization of food commodities. Its urgency attracted attention of the G20, but with little resolution. UN Special Rapporteur on the Right to Food, Olivier De Schutter, concluded after the June 2011 G20 meeting that:

the plan of action tries to address the symptoms of price volatility on agricultural markets, but it fails to address the causes. That the G20 still insists on the need for more studies rather than on the need to remove distorting fiscal incentives and subsidies . . . shows how commercial interests trump the concern for food security in this particular case.³⁴

Although the full complexity of food commodity speculation cannot be analyzed here, there is widespread agreement that price volatility promotes neither smallholder food production nor global food security.³⁵ As the UN-DESA/UNCTAD report concludes:

Many financial investors enter commodity markets with the motive of diversifying their portfolios, their position-taking being typically unrelated to the fundamentals of supply and demand in [food] commodity markets. They regard [food] commodities merely as an alternative class of assets, next to equities, bonds and so forth.³⁶

Such merger of food for humans with bullion speculation causes shifts in prices unrelated to relative scarcity (i.e., market supply/demand for food) and therefore, leads to greater price volatility, increasing farmer risks, and most often, raising prices.³⁷ It is also generally acknowledged that much of the food commodity trading by financiers is not recorded for OTC (over the counter) trading is really unregulated, "under-the-table" exchange.³⁸ Recent G20 meetings have not agreed to increased regulations nor have US government reforms advanced any.

Given these global food market conditions, African smallholder food producers will continue to produce for local markets, where prices remain more related to supply and demand, than to distant speculators clicking icons on their computers. African farming networks are claiming food sovereignty, the right to choose what diverse plants are eaten, how to produce them, and certainly, whether their choice of market is local, national or regional.³⁹ The global grain market, now a speculative commodity market, offers little or no attraction.

Darkness

Although climate change discussions never encompass increasing darkness, it is a major factor in policy hazards that endanger smallholder farmers. We define this "darkness" as insufficient transparency and accountability of international interests advancing the climate change agenda. As a result of neoliberal orthodoxy removing governments of developing countries from agriculture since the 1980s (via trade agreements and conditionalities as prerequisites for any capital transfers—loans, grants or investments), minimal public sector funds are available to finance agricultural research or extension.⁴⁰ Into this internationally

created void step private foundations to provide funds for agricultural research and some extension. For example, the Bill and Melinda Gates Foundation initiated, with the Rockefeller Foundation, the Alliance for a Green Revolution for Africa (AGRA) in late 2006. AGRA promotes the past-century approach to food production: increased yields from “improved seeds” under a farming system of large-scale monoculture. AGRA ignores expert advice coming from many sectors, including a two-year study by over twenty internationally recognized scientists, authorized by then UN Secretary General Kofi Annan, that African ecology is too varied for a green revolution approach; the study called for a “rainbow evolution” of multiple practices adapted to local conditions.⁴¹ AGRA practices also ignore the more recent (2009) and comprehensive IAASTD recommendations. Instead, AGRA proceeds with “one size fits all.”

Not accountable to anyone but its corporate parent, the Gates Foundation has sufficient funds to advance this farming system for Africa across many sectors, promoting expensive inputs of GM seeds, pesticides and fertilizers. Rajiv Shah, head of the US Agency for International Development (USAID), held various leadership roles at the Gates Foundation prior to becoming USAID Administrator, and US Secretary of Agriculture Thomas Vilsack is a strong advocate of the Foundation. Across Africa, the US’s Millennium Challenge Corporation finances this farming system’s approach to food production. The World Bank is jointly funding AGRA projects. For Africa directly, a NEPAD initiative, the Comprehensive Africa Agriculture Development Program (CAADP), receives major Gates Foundation funding to direct “strategic investments in agriculture.”⁴²

Though the CAADP program was endorsed by the African heads of state as a vision for restoring agricultural growth, food security, and rural development and enjoys significant political interest, philanthropic institutions largely influence ownership and control of the program. The aim is to stimulate agricultural-led development that is capable of eliminating hunger and poverty while enhancing food security and integrating farmers into the global market economy. The goal set out for CAADP is to attain an average annual growth rate of 6 percent in agriculture and 10 percent national annual budgetary allocation by each country. However, most countries are failing to meet the declared threshold of agricultural funding and depend on private sector agricultural support.⁴³

Through joint initiatives of CAADP with AGRA, the multinational agricultural corporations are promoting the introduction of gene-revolution monoculture, high technology, input intensive and global market-led agricultural economy.⁴⁴ CAADP does not promote farmer-centered agricultural innovation that is participatory, inclusive, and with a bottom-up approach, bringing the smallholder food producers to the center of agricultural policy and institutional reforms. Critics of the CAADP institutional frameworks and governance structures call for the organization to devote significant energy to involving farmers in agricultural policy reform processes for co-generation of appropriate technologies.⁴⁵

After forming AGRA, the Gates Foundation, directly and indirectly (e.g., Challenge Program: Harvest Plus, Generation), began major funding of several CGIAR centers, including ICRISAT (International Crop Research Institute for the Semi-Tropics), CIMMYT (International Center for Maize and Wheat Improvement), and IRRI (International Rice Research Institute).⁴⁶ ICRISAT is the world’s seed bank and research center for Africa’s indigenous crops, sorghum and millet. Working in the public domain, ICRISAT makes available any breeder seed requested, allowing the corporate scientists to have easy access to African genetic wealth. AGRA partners, having received the seed under the principle of

natural justice of sharing seed that sustains humankind, can take it into the laboratory, modify it a bit and patent it. The “new” seed is now private property of Syngenta or Monsanto or another corporation, which aggressively markets it as “climate ready.” Seed becomes quite like the software of Microsoft: sold under monopoly control made legal by technological claims of innovation.⁴⁷

The “darkness” of policy under the aegis of climate change symbolizes the lack of transparency and accountability of foundations that are setting food production agendas. The “darkness” also refers to the privatization of seeds freely shared for thousands of years and kept in the public domain until very recently, about fifteen years ago.⁴⁸ This policy obscurity can remove the ability of smallholder farmers to provide diverse foods for human health and sustenance. Its dangers are as imminent as any from climate change.

African Resilience to Resist and Sustain

Because of the above international policy threats, smallholder farmers are changing their language and actions from “mitigate” and “adapt” to “resist” and “sustain.” As the causes and continuing crises of climate change do not originate from the African continent, the international call for mitigation and adaptation means that Africans must accommodate the extensive effluent from outside the continent, with little end in sight to that pollution. The climate change crisis is in fact an energy crisis, emanating from the misuse of fossil fuels for production and transport, including agriculture.⁴⁹ Given this negative record, it is quite ironic that AGRA, among other initiatives, works to advance industrial agriculture into African food production. The continent is food insecure, but fossil fuel dependent monoculture is no cure, especially in times of climate change.⁵⁰ Mitigation and adaptation refer to directives of what the recipients of climate change must do, without relinquishing any control or power to them. African smallholder farmers are asked to adapt (e.g., by buying “climate ready” patented seeds) to global weather conditions caused by greenhouse gas emissions at the same time they are pressured to adopt a farming system on dependent fossil fuels. These policy directives are not compatible with scientific analyses of climate change, nor do they make economic sense, for they render the African farmers more dependent on the global market, controlled by a few corporations, for their inputs.⁵¹

African smallholders, and their civil society organizations (CSOs), are resisting this farming system that genetically modifies seeds without biosafety precautions, patents the farmer-bred germplasm, requires monoculture across a continent of diverse ecological zones, and tries to link their food production to global markets.⁵² They are resisting by organizing for laws to be passed and enforced by their governments, including biosafety laws as well as laws relating to access and benefit sharing and farmers’ rights.

As early as 2001, the African Union adopted the African Biosafety Model Law that is more stringent than the Cartagena Biosafety Protocol allowing governments to invoke the precautionary principle to prohibit admission of GM crops and seeds into their countries. In addition, national biosafety laws exist in seventeen African countries, and in many others, it is a work in progress. For example, on December 31, 2011 Ghana’s president signed into law a biosafety act (Biosafety Act, 2011 — Act 831). African CSOs continue to organize, especially against US policy to send GM maize and soya as food aid to the continent.⁵³ Enforcement of national biosafety laws is yet another effort. One dramatic success story arose from civil society organizing in Kenya in early 2010 against illegally imported GM grain shipments from South Africa. By August 2011, the chief executive of the Kenya Biosafety Board, Dr.

Roy Mugiira, was fired for allowing GM soya to be imported as food aid, contrary to Kenyan biosafety laws.⁵⁴

Further, the CBD and the international plant treaty (ITPGRFA) allow governments to protect their genetic resource wealth through regulations on access and benefit sharing (ABS). The unity parliament of Zimbabwe is the first on the continent to bring those regulations into law, requiring prior informed consent (PIC) of local communities as well as the central government before any genetic resources are taken.⁵⁵ CSOs (e.g., RAEIN-Africa, CBDC, CTDT, see note 34 above) organize workshops in various countries to train civil servants about ABS, assisting other countries to domesticate an ABS law.⁵⁶ Under the plant treaty, farmers' networks are also organizing for incorporating farmers' rights, as outlined above, into their national laws. In contrast to demands of the patent seekers, Africans argue that PBRs and FRs can exist side-by-side internationally and do not need to be exclusive. Such an alternative would delimit the ability of corporate plant breeders to patent just any materials they choose and would take benefit sharing beyond proclamations.

African CSOs also challenge the idea that there is "vacant land" in any of their countries for agrofuels. The land may not be cultivated when the satellite picture is taken, but it is providing sustenance to local communities. Common forests and grasslands provide fruits and medicines, beneficial insects (some eaten by humans as a free source of protein), pasturage, fuel, and most important, sites sacred to local traditions. Organizers in Tanzania and Mozambique have required their governments to reconsider land leases to foreigners.⁵⁷ Mozambicans can testify for their neighbor that a piece of land has been used by her for ten years to allow her to obtain a certificate affirming her right to the land (usufruct rights not ownership). This alternative only deters corporations seeking land for agrofuels, but it does deter. Land, more than a commodity in Africa, is strongly rooted in identity, fundamental to family and community relations.

While resisting international calls for adaptation and mitigation, African smallholder farmers respond with farming techniques and systems that sustain biodiversity of indigenous food crops in the midst of the storms of climate variability and policy persuasion. As mentioned above, their first choice is to sustain biodiversity by intercropping multiple varieties to attract beneficial insects in deterring pests, to enrich the soil, and to maximize use of available water. Conservation agriculture, one method combining no tillage with organic fertilizers and water harvesting, can rebuild highly degraded soil within a few seasons. Starting with about one-third the usual requirement of inorganic fertilizer combined with organic materials, this method removes the need for use of any inorganic fertilizers after two-four years, depending on the original state of the soil. Increased yields are harvested after just one planting. After about three years, the dream of fewer inputs creating dramatically more yields becomes a reality.⁵⁸ By resisting high doses of fertilizers and commercial seeds, the farmers sustain their own food production.

In several Southern African countries (e.g., Malawi, Mozambique, Zambia, and Zimbabwe), the authors have worked with farmers who also sustain their genetic wealth by creating community seed banks for *ex situ* conservation. They can borrow seed one season and return it with an additional amount at harvest, to increase the seed availability. In addition, families are providing heirloom seeds of vegetables, legumes, and grains, stored with their names on it, to the seed bank, to guarantee that strain remains viable beyond the family. Further, heirloom seeds offer genetic diversity, even though their traits may not be immediately useful.⁵⁹ To sustain the seed banks, farmers organize into participatory plant breeding (PPB) groups to select from among themselves who will be the designated seed

propagators and who might experiment with cross-breeding. All participants experiment with seed in different microclimates across their lands, sharing in participatory variety selection (PVS) for preferred traits for planting the next season, for multiplying seed, and for breeding. In Zimbabwe, smallholder farmer seed producers are successful enough in propagating sufficient quantities of high quality seed (certified) that they are selling (sorghum, millet, and OPV maize) to commercial seed companies. Farmers' local knowledge, expertise, and ability to grow substantial quantities of certified seed demonstrate that with enough capacity building smallholder farmers are competent commercial seed producers.

The local marketing of smallholder crops remains a challenge but again, the farmers are finding solutions. Solar dryers allow farmers' groups (one dryer to about ten families) to dry their green vegetables and tomatoes at harvest in order to allow storage. No longer dependent on quick availability either of transport or on selling vegetables when quantities in the market are high and prices low, the farmers gain more income. They remain in control of this "value-adding." They make highly nutritious drinks from sorghums and millets, which would easily challenge Coke for taste.

Another major challenge is the fact that data is collected by North visions of agriculture. For example, the World Bank and FAO still collect data on chemical fertilizer use per hectare as an indicator of "development," when high use of inorganic fertilizers really means soil degradation, the loss of its organic composition. From the view within the African continent, its lack of use of fossil fuel fertilizers, relative to any other continent, indicates hope that the soil can be revived for many future generations by use of organic fertilizers.

Data is defined and collected for certain interests, and many are questioning carbon trading as mitigation. The United Nations' REDD (Reducing Emissions from Deforestation and Forest Degradation) addresses the finding that removal of tropical forests contributes to 17 percent of carbon emissions which cause greenhouse gas warming. The goal is for industrialized countries and their corporations to pay developing countries to sustain their forests, not cut them. On the African continent the Democratic Republic of the Congo (\$1.8 million for one year), Tanzania (\$4.2 million for two years), and Zambia (\$4.5 million for two years) are three of the nine pilot countries across the globe.⁶⁰ The first problem concerns designation of eligibility for REDD: those cutting forests will be rewarded for cutting less (e.g. Indonesia, Papua New Guinea), while those who have preserved their tropical wealth (e.g., Costa Rica, Guyana) that benefits us all will probably receive nothing.

Another problem with REDD is in the counting of the data. Do we count at the national level? In short, no REDD benefits would be offered until the national statistics show reduced deforestation. But, the Obama Administration wants the counting to be at the local level, which means carbon credits will be awarded on one side of a fence, while deforestation continues on the other side. A third problem refers to over-supply, for if too many carbon credits are granted, it will reduce their price, which could adversely affect incentives for a wide range of activities such as solar or wind energy. Fourth, the counting is hard to keep out in the open or transparent, given carbon credits can be used in speculative transactions. Already by August 2009, several City of London traders were arrested on suspicion of fraud with trading carbon credits.⁶¹

Smallholder farmers are collecting their own data, beginning with the obvious one that the number of crops grown and eaten provides much more nutrition than genetically deficient monoculture of one grain. This production reality could be recognized internationally by changing the metrics used to measure yields. In Southern Africa, there is

discussion of beginning to measure the “nutritional density” of a hectare of crops, instead of yield by weight; if yields are used, then the call is for them to be measured by yield per unit of water as well as of land.⁶² Another metric just beginning to be discussed is the “carbon food print” of crops, or how much carbon emissions occur during the food production. None of these metrics is yet perfected or in full use, but early indicators suggest that smallholder intercropping would surpass large-scale monoculture in food production if any of these measures became standard ones. African smallholder farmers teach us that both food biodiversity and greater yields are essential for food security during this time of climate change.

African smallholder food producers are already employing many techniques to address climate change, as analyzed above. The policy implications, therefore, mainly raise the question of how to support and encourage their innovations. Smallholder food producers are responding by resisting inappropriate technologies and agricultural inputs while sustaining their farming system, using indigenous knowledge, genetic wealth, and organic inputs; they have demonstrated resilience by continuously modifying production techniques. Alternatives do exist and policies from national governments and international agencies can assure African food security under climate change by honoring African smallholder food sovereignty, expressed as their choices to exercise the precautionary principle and farmers’ rights and as their call for recognition of indigenous knowledge and for benefit sharing for the use of their genetic resources.

Notes

- 1 Mushita founded (1993) and directs the Community Technology Development Trust (CTDT), a non-governmental organization that has been facilitating smallholder organizing, especially in community seed banks and agroecological farming methods. CTDT has a policy analysis unit, which, for almost two decades, has been addressing international policies that affect smallholders. Thompson works regularly in the unit in Harare. CTDT often holds training sessions and conferences in Southern Africa to promote smallholder farmer network discussions on issues of land rights, farmers’ rights, biopiracy and access to genetic resources, GMOs, and agrofuels. Mushita and Thompson 2007, pp. 201-245.
- 2 Because this analysis addresses farming systems, it only distinguishes smallholder farms (one to five hectares) from industrial agriculture that directs attention to small commercial farms (fifty to one hundred hectares). For understanding the diversity among farmers, see the important class analyses of Bernstein 2010; Mueller 2011, 31-37; Van der Ploeg 2008. For a recent article analyzing the food security versus food sovereignty paradigmatic divide, see McMichael and Schneider 2011.
- 3 Official IPPC 4th Report for Africa: Solomon 2007. See also Drimie et al. 2011; Thornton et al. 2011; Ziervogel and Ericksen 2010; World Bank 2009.
- 4 Tsiko 2009.
- 5 UN-DESA/UNCTAD 2011, pp. 69, 71.
- 6 UN-DESA/UNCTAD 2011, pp. 50-52; UN-DESA 2010; Ocampo and Parra 2006, pp. 180, 183.
- 7 Weeks 2011, p. 1.

- 8 Kar and Cartwright Smith 2010, p. 1. Ndikumana and Boyce (2011, p. 46) calculate capital flight from thirty-three sub-Saharan Africa countries, 1970-2008 (in 2008 US dollars), at \$735 billion, or about 80 percent their combined 2008 GDP.
- 9 FAO 2009, p. 2. The Copenhagen Accord to disburse \$30 billion per year to developing countries indicates a new initiative but is not yet forthcoming, and the World Bank's Global Environmental Facility is also criticized for slow dispersal of funds (UN-DESA/UNCTAD 2011, p. 28).
- 10 Kar and Freitas 2011, p. 10.
- 11 In this study, "illicit" flows do not include misuse of intellectual property rights, smuggling, narcotics/contraband goods, human trafficking or sex trade.
- 12 Kar and Cartwright Smith 2010, p. 20.
- 13 Pardee 2012; Chowla 2011; International Monetary Fund 2010.
- 14 Chishakwe and Young 2003.
- 15 United Nations CBD, Article 8j.
- 16 Frozen embryos were taken from Zimbabwe without recognition nor benefit sharing, and the U.S. beef industry retained the name of 'tuli' (a derivative of "utuli," a Ndebele word meaning "dust," depicting the harsh conditions under which the cattle thrive). Highly valued as tolerant of coarse grasses and heat, the cattle provide excellent beef. They are already "adapted" to climate change—but only after 7000 years of careful African breeding (Mushita 2003). See North American Tuli Association: <http://dawhois.com/site/tuliassociation.com.html>
- 17 FAO Commission on Genetic Resources for Food and Agriculture 2011, p. 20.
- 18 UN-DESA/UNCTAD 2011, p. 25; see also Odagiri et al. 2010.
- 19 World Bank 2009, p. xviii.
- 20 In Zambia, the national poverty rate increases by 2.7 percent in a flood year and by about 7.5 percent in a drought year, pushing hundreds of thousands more below the poverty line (Nkhoma 2010, pp. 11-12).
- 21 Much depends on growing conditions, but on the average, one mature (after five years) jatropa tree will produce about one kilogram of seeds and at that yield, it takes four trees to make one liter of biodiesel (Ribeiro and Matavel 2009).
- 22 For example, Tyson Foods, Inc. is the world's largest marketer of chicken, beef and pork, as well as the market leader in retail and foodservice sales. Periodically banned from national markets because of safety concerns (e.g. Russia refused to import its chicken in 2010 and it lost \$800 million in beef exports to Asian markets in 2005), Tyson has increased its export of chicken to Africa from 2005. It is competitive in the South African poultry industry, where chicken is the fast food meat of choice. Tyson press releases: <http://www.tyson.com/Corporate/PressRoom/ViewArticle.aspx?id=2070>
- 23 WHO 2005; SAFAIDS 2004.
- 24 Solomon 2007, Table 11.1
- 25 Hernández and León 1994, p. v.
- 26 Monsanto acknowledged resistance of pink bollworms to Bollgard cotton, a first generation Bt GMO, while announcing a new GMO, Bollgard II, to fight them off (Bagla 2010, p. 1439). The Union of Concerned Scientists' report, Failure to Yield (Gurian-Sherman 2009), concludes that it makes little sense to support genetic engineering at the expense of technologies with better, long-term records of increasing

- yields.
- 27 Deininger 2010, p. xxxii; GRAIN 2012, p. 1.
 - 28 Von Braun et al. 2009, n.p.
 - 29 GRAIN 2012, p. 2.
 - 30 Ibid.
 - 31 Global Witness 2012; Oakland Institute 2011 a,b,c; Friis and Reenberg 2010, pp. 26, 29; Mozambique 2011; Chishakwe et al. 2011, pp. 10-11. For overviews, see GRAIN 2007; UNEP 2009; Daniel and Mittal 2009.
 - 32 Havnevik 2011; Thompson, 2008.
 - 33 Authors' fieldwork in Zimbabwe, 2008-2012.
 - 34 Tran 2011, n.p.; Cammack 2012.
 - 35 Jones 2010; UNCTAD 2009; FAO. Trade and Market Division 2009; Robles et al. 2009.
 - 36 UN-DESA/UNCTAD 2011, p. 53.
 - 37 Tang and Wei 2010.
 - 38 UN-DESA/UNCTAD 2011, p. 54.
 - 39 African smallholder farmers' advocacy organizations that hold regular (several times a year) workshops and information-sharing conferences are too numerous to list. The ones here are selected because each has a record of over ten years of working in farmers' communities, learning from them and facilitating policy recommendations from the ground; at the same time, they remain independent from governments, relying mainly on NGO funding to assist farmers' agendas. For example, they are all strongly advocating farmers' rights over seeds as well as enforcement of biosafety laws. as analyzed in this paper. Some are country specific, some regional, and other span the continent. Further, each one of these websites leads to many other organizations via the "Partners" link: Participatory Ecological Land Use Management (PELUM, <http://www.pelumrd.org/index.html>, a network of 230 member organizations); Regional Agricultural and Environmental Initiatives Network (RAEIN-Africa, www.raein-africa.org, based in Southern Africa); Réseau des Organizations Paysannes et de Producteurs d'Afrique de l'Quest (ROPPA, <http://www.roppa.info/?lang=en>); Eastern and Southern Africa Farmers' Forum (ESAFF, <http://www.esaff.org>, with members in twelve countries); African Biodiversity Network (ABN, <http://www.africanbiodiversity.org/content/home>, a network of 36 member organizations); Tanzania Alliance for Biodiversity (TABIO, <http://envaya.org/tabio> is an example of a national network of fifteen organizations). Community Technology Development Trust (CTDT, www.ctdt.co.zw) is an example of an organization with three country offices in one region, Southern Africa.
 - 40 Mushita and Thompson 2007, pp. 107-130.
 - 41 Inter-Academy Council 2004; Thompson 2007.
 - 42 AU/NEPAD/CAADP 2010, p. 11.
 - 43 In Maputo in 2003, African heads of state set targets of allocating 10 percent of national budgets to agriculture by 2008 and of reaching national agricultural growth rates of 6 percent, but only six countries reached the 10 percent goal. (AU/NEPAD/CAADP 2009, p. 8).
 - 44 Mushita 2011.
 - 45 Ibid.; Action Aid International 2011; African Civil Society 2002.

- 46 Community Technology Development Trust 2010. Sources and amount of funding of the CGIAR centers was compiled from their annual financial reports, 2006-2010.
- 47 Mushita and Thompson 2007.
- 48 Thompson 2009.
- 49 Intergovernmental Panel on Climate Change 2007, pp. 25-39; United Nations Environmental Program 2010, p. 38.
- 50 Weis 2010, p. 321; McMichael 2009; Norstad 2007; Pollan 2006, p 83; Pfeiffer 2006, pp. 19-28; Altieri 2000, pp. 77-87.
- 51 Thompson 2011.
- 52 Smallholder advocacy groups are flourishing, starting with the farmers' themselves, such as those organized in community seed banks and farmers' field schools, extending to public health (nutrition gardens) in rural clinics. Various non-governmental organizations sustain sharing of innovations, communication, and farmer exchange visits across regions of Africa. The advocacy groups vary by definition of their central concerns but share goals; in addition to those above in note 39, the following only gives a hint of the degree of mobilization: Indigenous Peoples of Africa Coordinating Committee (IPACC), Community Biodiversity Development and Conservation Programme (CBDC), Southern African Land and Agrarian Reform Network (SALARN), Southern African Confederation of Agricultural Unions (SACAU), Kenya Biodiversity Coalition (KBioC), and Union Maghrebine des Agriculteurs (UMAGRI).
- 53 IRIN 2011.
- 54 Gathura 2011.
- 55 Zimbabwe, Government of 2009.
- 56 A few examples of many: Chishakwe and Mafuratidze 2010; Munzara-Chawira and Mafuratidze 2009; Chishakwe and Young 2003.
- 57 Oakland Institute 2011a,b,c. Mandota 2011, pp. 15-24. Chishakwe et al. 2011, pp. 10-11.
- 58 Community Biodiversity Development and Conservation Programme 2009.
- 59 Fusire 2009.
- 60 UNREDD 2011.
- 61 Pearce 2010.
- 62 Work sessions, in which the authors participated, were held among extension workers in Lusaka and Harare in July 2012 to begin discussions for ways to measure "nutrition density" of a hectare.

References

- Action Aid International. 2011. *Making CAADP Work for Women Farmers: A Review of Progress in Six Countries*. <http://www.actionaid.org/publications/making-caadp-work-women-farmers-review-progress-six-countries> (accessed 30 June 2011).
- African Civil Society. 2002. "African Civil Society Declaration on NEPAD." http://www.sarpn.org/NEPAD/july2002/acs_declaration/African_Civil_Society.pdf (accessed 30 June 2011).

Altieri, Michael. 2000. "Ecological Impact of Industrial Agriculture and the Possibilities for Truly Sustainable Farming." In Fred Magdoff, et al. (eds.), *Hungry for Profit: The Agribusiness Threat to Farmers, Food and the Environment* (New York: Monthly Review Press): 77-92.

AU/NEPAD /Comprehensive Africa Agriculture Development Programme (CAADP). 2010. *Annual Report 2009*. http://caadp.net/pdf/CAADP_AR2010_WEB.pdf (accessed 8 May 2011).

AU/NEPAD/Comprehensive Africa Agriculture Development Programme (CAADP). 2009. *Annual Report 2008*. www.nepad-caadp.net/pdf/CAADP%20Annual%20report%202008.pdf (accessed 8 May 2011).

Bagla, Pallava. 2010. "India: Hardy Cotton-Munching Pests are Latest Blow to GM Crops." *Science* 327(5972): 1439.

Bernstein, Henry. 2010. *Class Dynamics of Agrarian Change*. Wallingford, UK: CABI Publishing.

Cammack, Paul. 2012. "The G20, the Crisis, and the Rise of Global Developmental Liberalism." *Third World Quarterly* 33.1: 1-16.

Chishakwe, Nyasha et al. (eds.). 2011. *Land and Biofuels in Southern Africa – National Policy Briefs*. Harare: Community Technology Development Trust and the Southern Africa Land and Agrarian Reform Network (SALARN).

_____ and Regis Mafurati (eds.). 2010. *Regional Training Workshop on Access to Genetic Resources and Sharing of Benefits Arising from their Use (ABS): A Training Workshop*. Harare: Community Technology Development Trust.

_____ and T. R. Young. 2003. *Access to Genetic Resources and Sharing the Benefits of Their Use: International and Sub-Regional Issues*. Harare: Pelum.

Chowla, Peter. 2011. *Time for a New Consensus. Regulating Financial Flows for Stability and Development*. London: Bretton Woods Project.

Community Technology Development Trust. 2010. "A Public Trust Betrayed? Policy Changes by CGIAR Centers Giving New Meaning to 'Foundation Seed.'" Unpublished Report, October.

Community Biodiversity Development and Conservation Programme. 2009. *Conservation Agriculture: A Sustainable Farming Manual-How to Grow Your Crops with Minimal Inputs and Maximal Output*. Harare: Community Technology Development Trust.

Daniel, Shepard, with Anuradha Mittal. 2009. *The Great Land Grab Rush for World's Farmland Threatens Food Security for the Poor*. Oakland: Oakland Institute.
http://media.oaklandinstitute.org/sites/oaklandinstitute.org/files/LandGrab_final_web.pdf (accessed 6 July 2011).

Deininger, Klaus, et al. 2010. "Rising Global Interest in Farmland: Can it Yield Sustainable and Equitable Benefits?" Washington DC: World Bank Publications.
http://www.ds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/02/08/000334955_20110208033706/Rendered/PDF/594630PUB0ID1810Box358282B01PUBLIC1.pdf (accessed 12 October 2012).

Drimie, S. et al. 2011. "Global Environmental Change and Food Systems in Southern Africa: The Dynamic Challenges Facing Regional Policy." *Journal of Geography and Regional Planning* 4.4: 169-82.

Food and Agriculture Organization of the United Nations (FAO). 2009. "Rapid Assessment of Aid Flows for Agricultural Development in Sub-Saharan Africa." Investment Center Division Discussion Paper, September. www.fao.org (accessed 7 July 2010).

_____. 2004. *International Treaty on Plant Genetic Resources for Food and Agriculture*. Rome: FAO. www.planttreaty.org (website of treaty).

_____. Commission on Genetic Resources for Food And Agriculture. 2011. *Biotechnologies for Agricultural Development*. CGRFA/WG-PGR-5/11/Inf. 27-29 April, Rome. [http://typo3.fao.org/fileadmin/templates/agphome/documents/PGR/ITWG/ITWG5/final/Information Document 11.pdf](http://typo3.fao.org/fileadmin/templates/agphome/documents/PGR/ITWG/ITWG5/final/Information_Document_11.pdf).

_____. Trade and Market Division. 2009. *The State of Agricultural Commodity Markets. High Food Prices and The Food Crisis— Experience and Lessons Learned*. <ftp://ftp.fao.org/docrep/fao/012/i0854e/i0854e.pdf>.

Friis, Cecilie, and Anette Reenberg. 2010. *Land Grab in Africa: Emerging Land System Drivers in a Teleconnected World*. GLP Report No. 1. GLP-IPO, Copenhagen.

Fusire, Marceline (ed). 2009. *The Principle of Community Seed Banking: A Guide to Germ Plasm Conservation, Restoration and Utilization in Marginalized Communities of Southern Africa*. Harare: Community Biodiversity Development and Conservation.

Gathura, Gatonye. 2011. "Kenya's Biosafety Chief fired over GM Food Import Procedures." *The Nation* (Kenya) 26 August. Reprinted in <http://www.africanagricultureblog.com/2011/08/kenyas-biosafety-chief-fired-over-gm.html> (accessed 15 October 2012).

Global Witness, et al. 2012. "Dealing with Disclosure: Improving Transparency in Decision-Making over Large-Scale Land Acquisitions, Allocations and Investments." April. http://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/Dealing_with_disclosure.pdf (accessed 13 October 2012).

GRAIN. 2012. "Land Grabbing and Food Sovereignty in West and Central Africa." 19 September. <http://www.grain.org/article/entries/4575-land-grabbing-and-food-sovereignty-in-west-and-central-africa> (accessed 12 October 2010).

_____. 2007. "The New Scramble for Africa." *Seedling* July (Agrofuels Special Issue): 36-45.

Gurian-Sherman, Doug. 2009. *Failure to Yield. Evaluating the Performance of Genetically Engineered Crops*. Cambridge, MA: Union of Concerned Scientists, April. http://www.ucsusa.org/assets/documents/food_and_agriculture/failure-to-yield.pdf (accessed 3 August 2011).

Havnevik, Kjell. 2011. "Grabbing of African Lands for Energy and Food: Implications for Land Rights, Food Security and Smallholders." In Prosper Matondi, et al. (eds.) *Biofuels, Land Grabbing and Food Security in Africa* (Uppsala: Nordic Africa Institute and London: Zed Books): 20-43.

- Hernández, Bermejo, and J. León (eds.). 1994. *Neglected Crops: 1492 from a Different Perspective*. Rome: FAO.
- Inter-Academy Council. 2004. *Realizing the Promise of African Agriculture*. Amsterdam. <http://www.interacademycouncil.net/CMS/Reports/AfricanAgriculture.aspx>.
- Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment. Geneva: IPCC at World Meteorological Organization. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm (accessed 10 October 2012).
- International Assessment on Agricultural Knowledge, Science and Technology for Development (IAASTD). 2009. *Agriculture at a Crossroads*. <http://www.agassessment.org/>.
- International Monetary Fund Staff Position Note. 2010. *Capital Inflows: The Role of Controls*. Washington, DC: International Monetary Fund. 19 February. <http://www.imf.org/external/pubs/ft/spn/2010/spn1004.pdf>.
- IRIN (Service of the UN Office for the Coordination of Humanitarian Affairs). 2011. "FOOD: Rumpus over GM Food Aid," 12 October. <http://www.irinnews.org/Report/93991/FOOD-Rumpus-over-GM-food-aid> (accessed 10 October 2012).
- Jones, Tim. 2010. *The Great Hunger Lottery: How Banking Speculation Causes Food Crises*. London: World Development Movement. http://www.wdm.org.uk/sites/default/files/hunger%20lottery%20report_6.10.pdf (accessed 11 January 2012).
- Kar, Dev, and Sarah Freitas. 2011. *Illicit Financial Flows from Developing Countries over the Decade Ending 2009*. Global Financial Integrity. www.gfip.org (accessed 1 March 2012).
- _____ and Devon Cartwright Smith. 2010. *Illicit Financial Flows from Africa - Hidden Resource for Development*. Global Financial Integrity. www.gfip.org (accessed 8 July 2010).
- Tang, Ke, and Wei Xiong. 2010. "Index Investment and Financialization of Commodities." NBER Working Paper No. 16385. Cambridge, MA: National Bureau of Economic Research.
- Mandota, Simba (ed.). 2011. *Biofuel Development, Land Use and Livelihoods in Southern Africa: A Synthesis of Cases from Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe*. Harare: Community Technology Development Trust and the Southern Africa Land and Agrarian Reform Network (SALARN).
- McMichael, Philip. 2009. "A Food Regime Analysis of the 'World Food Crisis.'" *Agriculture and Human Values* 26: 281-95.
- _____ and Mindi Schneider. 2011. "Food Security Politics and the Millennium Development Goals." *Third World Quarterly* 32.1: 119-39.
- Metz, B., et al. (eds.). 2007. "Mitigation of Climate Change." In *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge: Cambridge University Press.

Mozambique, Government of. 2011. "Approved Investment Projects, 2007-2009 [for land]," summarized by The Oakland Institute. <http://media.oaklandinstitute.org/land-deals-africa/mozambique> (accessed 29 July 2011).

Mueller, Bernd. 2011. "The Agrarian Question in Tanzania: Using New Evidence to Reconcile an Old Debate." *Review of African Political Economy* 38.127: 23-42.

Munzara-Chawira, M., and R. Mafuratidze. 2009. *Farmers' Rights Training Manual: A Guide for Law Enforcement Agencies, Civil Society Organizations, Universities and all Stakeholders*. Harare: Community Technology Development Trust.

Mushita, Andrew. 2011. "Assessing CAADP (The Comprehensive African Agricultural Development Programme) as a Policy Framework for African Agricultural Development. Harare: Community Technology Development Trust." Unpublished report.

_____. 2003. "Bioprospecting and Commercialising Traits of the Golden Beast of Zimbabwe: The Case of the Tuli Indigenous Cattle." Harare: Community Technology Development Trust.

_____ and Carol Thompson. 2007. *Biopiracy of Biodiversity: Global Exchange as Enclosure*. Trenton, N.J.: Africa World Press.

Ndikumana, Léonce, and James Boyce. 2011. *Africa's Odious Debts: How Foreign Loans and Capital Flight Bled a Continent*. London: Zed Books.

Norstad, Aksel (ed.). 2007. *Africa Can Feed Itself*. Oslo: The Development Fund.

Nkhoma, Charles. 2010. "Impact/Relationship of Climate Change, Agro-fuels and Modern Biotechnology on Agriculture and Agro-biodiversity in Zambia." Paper presented at "Round Table: Validating Research Findings on the Impacts of Climate Change, Agro fuels and Modern Biotechnology on Agriculture," Johannesburg, 28 April.

Oakland Institute. 2011a. "Agrisol Energy and Pharos Global Agriculture Fund's Land Deal in Tanzania." *Understanding Land Investment Deals in Africa: Land Deal Brief*. http://media.oaklandinstitute.org/sites/oaklandinstitute.org/files/OI_Agrisol_Brief.pdf (accessed 29 July 2011).

_____. 2011b. "Hedge Funds Create Volatility in Global Food Supply with Land Grabs Across Africa." Press release, 8 June. <http://oaklandinstitute.org> (accessed 29 July 2011)

_____. 2011c. "Land Deal Brief: Eight Myths and Facts About AgriSol Energy in Tanzania." http://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/OI_brief_myths_and_facts_agrisol_energy_1.pdf (accessed 15 October 2012).

Ocampo, José Antonio, and Maria Angela Parra. 2006. "The Commodity Terms of Trade and their Strategic Implications for Development," In K. S. Jomo (ed.) *Economic Globalization, Hegemony and the Changing World Economy During the Long Twentieth Century* (Oxford: Oxford University Press): 164-94.

Odagiri, Hiriyuki, et. al. 2010. "Conclusion." In Hiriyuki Odagiri, et al (eds.), *Intellectual Property Rights, Development, and Catch-up: An International Comparative Study* (Oxford: Oxford University Press): 412-30.

Pardee Center Task Force. 2012. *Regulating Global Capital Flows for Long-Run Development*. Boston: Boston University.

Parry, M.L., et al. (eds.). 2007. "Impacts, Adaptation and Vulnerability." *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC.)* Cambridge: Cambridge University Press.

Pearce, Fred. 2010. "Will REDD Preserve Forests or Merely Provide a Fig Leaf?" *Environment 360*, Yale School of Forestry and Environmental Studies, 27 May. <http://e360.yale.edu/content/feature.msp?id=2277> (accessed 2 August 2011).

Pfeiffer, Dale Allen. 2006. *Eating Fossil Fuels: Oil, Food and the Coming Crisis in Agriculture*. Gabriola Island, BC: New Society Publishers.

Pollan, Michael. 2006. *The Omnivore's Dilemma: A Natural History of Four Meals*. New York: Penguin.

Ribeiro, Daniel and Nilza Matavel. 2009. *Jatropha! A Socio-Economic Pitfall for Mozambique*. Maputo: Justiça Ambiental & União Nacional de Camponeses.

Robles, Miguel, et al. 2009. *When Speculation Matters*. IFPRI Issue Brief 57. Washington, DC: International Food Policy Research Institute, February. <http://www.ifpri.org/sites/default/files/publications/ib57.pdf> (accessed 8 August 2011).

Solomon, S., et al. (eds.). 2007. "The Physical Science Basis." *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. [Chapter 11- Regional Climate Projections, Africa: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch11s11-2.html].

Southern Africa HIV/AIDS Information Dissemination Service (SAFAIDS). 2004. *Eating Healthy, Staying Positive: Manual on Nutrition for HIV Positive People*. http://www.safaid.net/files/Eating_healthy_staying_positive_NutritionManual.pdf (accessed 2 October 2012).

Steinbrecher, Ricarda, et al. 2008. "Agrofuels." Unpublished seminar presentation at COP-9 Conference, Bonn, Germany, 16 May.

Thompson, Carol. 2011. "Cartels Chaining the Global Food Agenda: BOPping the Hungry." *Pambazuka News*. 28 September. <http://www.pambazuka.org/en/category/features/76694>

_____. 2009. "The Scramble for Genetic Resources." In Roger Southall and Henning Melber (eds.), *A New Scramble for Africa? Imperialism, Investment and Development* (Durban: University of Kwazulu Natal Press): 299-323.

_____. 2008. "Agrofuels from Africa, not for Africa." *Review of African Political Economy* 35.117: 516-19.

_____. 2007. "Africa: Green Revolution or Rainbow Evolution?" *Foreign Policy in Focus*. July. <http://www.fpif.org/fpif.txt/4398>

Thornton, P.K., et al. 2011. "Agriculture and Food Systems in Sub-Saharan [sic] Africa in a 4°C+ World." *Philosophical Transactions of the Royal Society* 369: 117-36.

Tran, Mark. 2011. "G20 Ministers Agree Action Plan to Curb Food Price Volatility." *The Guardian* (London), 23 June. <http://www.guardian.co.uk/global-development/2011/jun/23/g20-action-plan-to-curb-food-prices> (accessed 5 July 2011).

Tsiko, Sifelani, (ed). 2009. *Agro-Biodiversity Feeds the World: Status Report on Agro-Biodiversity in Africa*. Harare: Community Biodiversity Development and Conservation Programme.

United Nations. 2011. Official Website: *Reducing Emissions from Deforestation and Forest Degradation (UNREDD)* www.unredd.org.

United Nations. *Convention on Biological Diversity (CBD)*. 1993. New York: UNEP. www.cbd.int/convention.

United Nations Department of Economic and Social Affairs (UN/DESA). 2010. *Quarterly and Monthly Tables of Import/Exports and Terms of Trade* <http://unstats.un.org/unsd/trade/imts/analyticaltradetables.htm>.

_____ and the United Nations Conference on Trade and Development (UNCTAD). 2011. *World Economic Situation and Prospects 2011*. New York: UN. http://www.unctad.org/en/docs/wesp2011_en.pdf.

United Nations Environment Programme (UNEP). 2010. "Assessing the Environmental Impacts of Production and Consumption: Priority Products and Materials." http://www.unep.org/resourcepanel/Portals/24102/PDFs/PriorityProductsAndMaterials_Report.pdf

_____. International Panel for Resource Management. 2009. *Toward Sustainable Production and Use of Resources: Assessing Biofuels*. <http://www.unep.fr/scp/rpanel/Biofuels.htm>

United Nations Conference on Trade and Development (UNCTAD). 2009. "The Financialization of Commodity Markets." *Trade and Development Report 2009*. (Geneva: UNCTAD): 53-84. http://www.unctad.org/en/docs/tdr2009_en.pdf.

van der Ploeg, Jan Douwe. 2008. *The New Peasantries: Struggles for Autonomy and Sustainability in an Era of Empire and Globalization*. London: Earthscan.

von Braun, Joachim, and Ruth Meinzen-Dick. 2009. "'Land Grabbing'" by Foreign Investors in Developing Countries: Risks and Opportunities." *IFPRI Policy Brief 13*. April. <http://www.ifpri.org/publication/land-grabbing-foreign-investors-developing-countries> (accessed 12 October 2012).

Weeks, John. 2011. "John Weeks Reviews: Africa's Odious Debts." *African Arguments* (Royal African Society) 5 October. <http://tinyurl.com/4y48pc9> (accessed 1 March 2012).

Weis, Tony. 2010. "The Accelerating Biophysical Contradictions of Industrial Capitalist Agriculture." *Journal of Agrarian Change*. 10.3: 315-41.

World Bank, Sustainable Development Department. 2009. *Making Development Climate Resilient: A World Bank Strategy for Sub-Saharan Africa*. Report No. 46947-AFR. Washington, DC: World Bank. http://siteresources.worldbank.org/INTAFRICA/Resources/ClimateChange-StrategyReport2010-Full_vNoImages.pdf.

World Health Organization. 2005. "Consultation on Nutrition and HIV/AIDS in Africa: Evidence, Lessons and Recommendations for Action." Durban, South Africa." 10-13 April. www.who.int/entity/nutrition/topics/Executive_Summary_Durban.pdf.

Ziervogel, Gina, and Polly Ericksen. 2010. "Adapting to Climate Change to Sustain Food Security." *Climate Change* 1.4: 525-40.

Zimbabwe, Government of. 2009. "Environmental Management (Access to Genetic Resources and Indigenous Genetic Resource-based Knowledge) Regulations." Statutory Instrument 61 of 2009.