

# A Socially Inclusive Pathway to Food Security: The Agroecological Alternative

By Ben McKay

## I. Introduction

With roughly 1 billion people unable to meet their minimum daily caloric intake, the issue of food security is imperative to overcoming rural poverty. The way in which we produce food plays an extremely important role in solving the hunger epidemic and reaching the first Millennium Development Goal (MDG) of eradicating extreme hunger and poverty. The dominant model of agricultural development practised by many countries today is based on chemical-intensive agro-industrial complexes growing monocultures for export. This model of corporate-controlled agro-industry has failed to produce positive results economically, environmentally or socially. As one of the main contributors of greenhouse gas emissions, the agro-industrial model is exacerbating global climate change, degrading arable land, deteriorating public health, decreasing food quality and disrupting traditional rural livelihoods. Although this model was deemed to produce higher yields and increase productivity, it has failed to increase food security around the world. In fact, since the United Nations' Food and Agriculture Organization (FAO) started calculating the number of undernourished persons worldwide in 1969, the number of hungry people has increased by about 8 per cent—from 878 million in 1969 to an estimated 925 million in 2010 (FAO, 2012).

Based on a myriad of scientific research and satellite cases worldwide, there is a general consensus and growing support among experts around the world that an agricultural model based on agroecology can provide a sustainable, socially inclusive, productive and efficient way forward to increase food security and alleviate rural poverty.<sup>1</sup> As a science and set of practices, agroecology is very knowledge-intensive, participatory, organised and innovative. Derived from the convergence of two disciplines—agronomy and ecology—agroecology implies farming methods based on diversification, biological interactions and agroecosystem synergies which generate and enhance soil fertility, productivity and crop resilience. Despite its emphasis on sustaining the environment and social inclusion through participatory frameworks, agroecology-based models have produced impressive economic results in terms of yields, productivity and efficiency.<sup>2</sup>

This Policy Research Brief draws on case studies in Brazil and Cuba, as well as analytical papers on agroecology in theory and practice, to contribute to the discussion on how countries can pursue a national agricultural development model based on agroecology. Drawing on the case study experiences, the institutionalisation of an agroecology-based farm system must come from both the state—with support services and investments—and society—with farmer-to-farmer networks and socially inclusive participatory organisations. In Cuba, with the government lacking adequate resources, the agroecological movement was largely based on societal actors in the form of rural labour organisations mobilising and creating farmer-to-farmer networks. Although born out of necessity, the Cuban experience exemplifies the importance and effectiveness of farmers using social capital to innovate and overcome difficulties with alternative forms of production. In Brazil, although rural labour organisations are increasingly gaining influence and participating in policy discussions, the state's comprehensive agricultural policies provide substantial support, extension and investment for family farmers. The challenge is to scale up these programmes and create increased incentives for agroecology-based production within the current policy framework.

## II. An alternative Food System: Agroecology

The core principles of agroecology are based on using and recycling the nutrients and energy of the ecosystem in complementary and diversified ways to create a biodiverse, resilient, fertile environment. It is a discipline that is extremely innovative and knowledge-intensive, focusing on farmer knowledge and using farmer-to-farmer participatory methods and exchange networks to share ideas, techniques and practices. Using the knowledge and expertise of those most familiar with the ecosystem and its weather patterns, local farmers use a diversity of complex management schemes and adaptation techniques to strengthen ecosystem resilience and minimise dependence on agro-chemical and energy inputs.<sup>3</sup>

In a comprehensive study of 57 less developed countries (LDCs), 286 agricultural sustainability projects consisting of 12.6 million small farmers were evaluated after adopting agroecological practices. Occupying a total of 37 million hectares, or an average of just under three hectares per farmer, the average increase in crop yield from using agroecology-based techniques was 79.2 per cent. Based on a variety of farming systems—from smallholder-irrigated, rain-fed, wetland, humid, highland, mixed and urban—

smallholder-irrigated and urban-based farms saw the highest increases, with an average of 129.8 per cent and 79.2 per cent, respectively (Pretty et al., 2006). This study exemplifies the potential of pursuing an agroecology-based farm system. The 37 million hectares of farmland evaluated in the study represent a mere 3 per cent of the total cultivated area in LDCs. An agroecology-based farming system implemented on a much larger scale would undoubtedly increase crop yields per hectare in a socially inclusive and sustainable manner.

By lessening, or removing altogether, dependence on external, synthetically based inputs, smallholders will not have to use their incomes or become indebted to nurture their chemical-dependent crops. Although international food prices have increased in the past few years, the price of fertilisers and crude oil products have more than doubled the rise in foodstuff prices, making these external inputs increasingly more expensive for smallholders (de Schutter, 2011). Eliminating the reliance on such external inputs will, therefore, have a positive impact, not only on smallholder incomes but also on the long-term sustainability of their land and available resources.

The nature of agroecology farm systems is based on smallholder and cooperative farms. This is due to the multi-functionality of agroecology farm systems, their less mechanised nature and the inverse relationship between farm size and output, rendering small farms more productive than large farms in terms of total output per unit area.<sup>4</sup> This implies much more labour-intensive and diverse strategies in managing people, plants and animals. Due to the higher levels of underemployment in rural areas, a model of agriculture which is more labour-intensive

will increase employment, decrease rural-to-urban migration and provide social protection for rural livelihoods through cooperatives, farmer-to-farmer support systems and participation in peasant organisations.

### III. Gaining Ground: the Agroecology Movement in Latin America

#### Brazil

In Brazil, agroecology started gaining ground in academia as an alternative vision of agriculture in the 1980s. Researchers and non-governmental organisations (NGOs) such as Assessoria e Servicos a Projetos em Agricultura (AS-PTA) first started disseminating information on the agroecology alternative. This became central to farmer-to-farmer cooperation and knowledge sharing.<sup>5</sup> Under the Ministry of Science and Technology (MCT), the National Council for Scientific and Technological Development (CNPq) incorporated agroecology into its research initiatives, as did the Coordination of Improvement of Higher Education Personnel (CAPES) under the Ministry of Education. This played a major role in the institutionalisation process of agroecology into research and implementation processes in both academic and independent research institutions, governmental departments and, ultimately, on the farm.

The Brazilian Association of Agroecology (ABA)—comprised of small farmers, researchers and NGOs—has also been instrumental in the institutionalisation and implementation of agroecology in Brazil. The ABA works in conjunction with the Latin American Scientific Society of Agroecology (SOCLA), a regional network of researchers, professors, experts etc. which promotes agroecology as an alternative to the crisis

**Table 1**  
**Brazil's Assessoria e Servicos a Projetos em Agricultura (AS-PTA) Participatory Farmer Network**

<b>Step One</b>	Engage with local farmer organisations about alternative food systems
<b>Step Two</b>	Identify main problems and potentials of farmers' agroecosystems
<b>Step Three</b>	Analyse problematic causes using a participatory rural appraisal (PRA), engaging farmers, scientists, technicians, academics etc.
<b>Step Four</b>	Broadcast the results of the PRA on local radio, televisions, community boards.
<b>Results</b>	<p><b>Participatory and productive</b></p> <ul style="list-style-type: none"> <li>• 100, 000 agroecology-based family farmers</li> <li>• 100%–300% average yield increases</li> <li>• AS-PTA PRA system spread to over 200 communities in 15 municipalities, involving 10, 000 farmers in the state of Parana alone.</li> </ul> <p><b>Sustainability and resilience</b></p> <ul style="list-style-type: none"> <li>• Agronomic problems resolved issues of soil management, fertilisation, pest controls, traditional variety seed production and improvement, agroforestry.</li> <li>• Traditional crop varieties recovered: beans, corn, potatoes, rice, wheat, manioc.</li> </ul> <p><b>Efficient and cost-effective</b></p> <ul style="list-style-type: none"> <li>• Government extension agency through PRONAF calculates a yearly cost of \$500 per farmer assisted, which is 10 times more than agroecological participatory development approaches which also include research and farmer organisations' capacity-building costs.</li> </ul>

Source: Cohn et al., 2006.

of industrial agriculture. In 2002, the National Articulation of Agroecology (ANA) emerged as an arena for movements, networks and civil society organisations to promote and share experiences of agroecology systems in practice.

Even the agri-business-oriented Brazilian Agricultural Research Corporation (EMBRAPA) has programmes on agroecology and collaborates with ABA and ANA on agroecology-based research. The largest rural labour organisations in Brazil—the Landless Worker's Movement (MST), the National Confederation of Rural Trade Unions (CONTAG) and the Federation of Family Farmers (FETRAF)—have also been active, though to different degrees, in promoting and pursuing agroecology in practice. The MST has created 12 Agroecology Autonomous Schools, as well as the Centro 'Chico Mendez' and the Escuela Latinoamericana de Agroecología in Parana. This type of grassroots support from below has encouraged and influenced policy implementation from above.

In practice, it is the small family farms which have implemented agroecological techniques. Approximately 100,000 family farms have adopted agroecological farming practices in Brazil today—showing average yield increases of 300 per cent and 100 per cent for black beans and corn, as well as increasing resilience to irregular weather patterns (Cohn et al., 2006).

Family farms in Brazil account for 84.4 per cent of all farm production units but occupy just 24.3 per cent of the total area of rural establishments.<sup>6</sup> With an average farm size of 18.37 hectares, family farms employ 74.4 per cent of the total agricultural workforce and produce 70 per cent of all food products consumed by Brazilians daily (IBGE, 2009).

Although family farms do not guarantee agroecological techniques, they are conducive to the development of an agroecological model. Small farms are more productive in terms of overall outputs per hectare, more efficient, diverse and resource-conserving and employ more people. Due to the inherent connection to the land that most family farms have, they are also much better stewards of the environment and natural resources.<sup>7</sup> Supporting small family farms is, therefore, an important component of agroecology. Due to their increasing importance, the Brazilian government has implemented several programmes specifically targeting family agriculture within its overall national strategy on food and nutritional security, Zero Hunger.

Under The Ministry of Agrarian Development (MDA), the National Programme for the Strengthening of Family Farming (PRONAF) provides access to low-interest credit for family farmers. The Technical Assistance and Rural Extension (ATER) programme provided technical support and extension for 2.3 million families in 2010 (MDA, 2010). ATER provides technical support for crop-diversification techniques and irrigation systems and aims to strengthen productive organisation and stimulate agroecology-based productive systems. ATER also has a sectoral policy which specifically focuses on support for women, which was established under the National Technical Assistance and Rural Extension Programme (PRONATER) in 2004. By 2009, 90 projects were established through a R\$16 million investment, benefiting 31,000 women (MDA, 2010).

Brazil's Food Acquisition Programme (PAA) was launched in 2003 to ensure the public purchase of family farming products to meet the needs of populations facing food and nutrition insecurity. Family farmers receive a fair price from the federal government based on a regional market value average. These products are then donated to people facing food insecurity through schools, day care centres, shelters, hostels, nursing homes, hospitals and NGOs. Between 2003 and 2009, 764,000 family farms participated in the PAA, benefiting 7.5 million people per year (MDA, 2010). To encourage agroecological-based production, the PAA offers a 30 per cent price increase above the market average to agroecological producers.

To further strengthen family farmers' market access, the School Meal Law of the National School Meal Programme (PNAE) was established and passed in 2009, which determines that at least 30 per cent of school meal funds transferred by the National Education Development Fund (FNDE) must be purchased from family farms. The PNAE provides meals to public schools, feeding 47 million students with crops from local family farmers.

Although these programmes exclusively support family farms, they do not exclusively support agroecology. However, they exemplify how agricultural policies can be designed with a dual-track approach of supporting (family farm) production and social protection for poor people. Brazil has now successfully established the institutional capacity to effectively implement such a strategy, and with a few changes of increased incentives, support and protection specifically for agroecological practices within the existing framework, the country could further transform its family farm agriculture into one based on agroecological practices.

In December 2011, the Brazilian Association for Agroecology hosted the VII Brazilian Congress of Agroecology (CBA) in Fortaleza. This brought together over 4000 participants including the Ministry of Agriculture, Livestock and Food Supply, farmer organisations, experts and academics to discuss strategies for building policy to involve the public and private sectors. Moreover, discussions regarding a National Policy for Agroecology and Organic Production are currently underway, with a workshop held in early March 2012 with numerous organisations led by ANA as well as several governmental bodies such as MMA, MAP, MDS, MDA, CONAB and INCRA.<sup>8</sup> The coordinator of agroecology at the Ministry of Agriculture, Livestock and Supply (MAPA), Rogério Dias, also plans to address agroecology as a main subject at the UN Conference on Sustainable Development (Rio+20) in Rio de Janeiro in June 2012.

### **Cuba**

When the Soviet Union collapsed in 1991, Cuba lost its trade preferences with the Soviet Bloc and entered its 'Special Period in Time of Peace'. With a substantial decrease in trade, Cuba suffered an immediate decline in agricultural production with the loss of petroleum-based imports, machinery, fertilisers and pesticides (Altieri and Funes-Monzote, 2012). From 1990 to 1993, Cuba's Food Production Index dropped by nearly 40 per cent, causing massive food shortages across the country. Due to this crisis, the Cuban National Programme of Action and Nutrition (PNAN) was

**Table 2**  
**Support for Family Farming in Brazil**

Programme	Mandate	Results
<b>National Programme for the Strengthening of Family Farming (PRONAF)</b>	Provides four types of credit lines for family farmers <ul style="list-style-type: none"> <li>• Defrayal</li> <li>• Investment</li> <li>• Agroindustry</li> <li>• Agroecology</li> </ul>	<ul style="list-style-type: none"> <li>• PRONAF funds in 2010–2011: R\$16 billion</li> <li>• Average loan: R\$7478 per family</li> <li>• PRONAF financed over 2 million contracts in 2009</li> </ul>
<b>Technical Assistance and Rural Extension (ATER)</b> <b>ATER Sectoral Policy for Women</b>	Provides technical support and extension for family farmers and small farmers settled under the land reform programme Specifically designed for women to strengthen productive organisation, stimulate agroecology and ecologically based production and increase access to public policies	<ul style="list-style-type: none"> <li>• ATER funds in 2010: R\$626 million</li> <li>• ATER provides rural extension services to over 2.3 million people</li> </ul> <p>By 2009, 31,000 women had benefitted from ATER projects with R\$16 million in investments</p>
<b>Food Acquisition Programme (PAA)</b>	Government purchases food items directly from family farmers at a set fair price (based on regional market average) and distributes to people facing food insecurity. A 30% price increase is offered to agroecological producers	<p>PAA 2003–2009</p> <ul style="list-style-type: none"> <li>• 764,000 family farm participants (suppliers)</li> <li>• Annual average income from PAA: R\$3900 per family</li> <li>• Food products procured: 2.5 million tons</li> <li>• PAA funds for procuring food: R\$2.7 billion</li> <li>• Beneficiaries: 7.5 million/year</li> </ul>
<b>National School Meal Programme (PNAE)</b>	School Meal Law requires that 30% of school meal funds must come from local family farmers	<ul style="list-style-type: none"> <li>• PNAE provides food for 47 million students across Brazil</li> <li>• Overall potential market for family farms within the PNAE is R\$1 billion/year</li> <li>• Family farms can generate an estimated R\$9000/year</li> </ul>
<b>Family Farming Insurance (SEAF)</b> <b>Garantia-Safra (Harvest Insurance)</b> <b>Price Guarantee Programme for Family Farming (PGPAF)</b>	Insurance scheme which covers crop losses which exceed 30% of a harvest due to natural events Designed for small family farmers producing in non-irrigated areas measuring from 0.6 to 10 hectares located in semi-arid zones of Minas Gerais and north region of Espírito Santa state Protects family farmer beneficiaries of PRONAF's defrayal and investment lines against price volatility	<p>Since 2004 SEAF has assisted 500,000 families with payments amounting to R\$200 million/year</p> <p>Garantia-Safra covers 860 municipalities and assisted 661,000 family farmers in 2009–2010</p> <ul style="list-style-type: none"> <li>• 2009–2010: 35 crops were insured</li> <li>• Price guarantee covers up to R\$5000 annually per beneficiary</li> </ul>
<b>Family Farming Seal</b>	Certifies products that use at least 51% of raw materials produced by family farming	Benefits the 4,367,902 family farm units in Brazil with preferred market access

Source: MDA, 2010.

established as a result of the International Nutrition Conference in Rome in 1992. PNAN implemented a widespread decentralisation of landholdings, management and production. More autonomy was given to small farmers and peasants—who, in the end, became the key actors in the transformative process.

Farmers were forced to re-orient their agricultural production, based on innovative methods of agroecology. Using a model of agricultural development not based on chemical fertilisers and heavy machinery, Cuba increased its food

production by 37 per cent from 1995 to 2004—an annual average of 4.1 per cent—far surpassing the regional average of 0 per cent during the same period (FAO, 2012). The Cuban model of agroecology in both rural and urban areas has produced impressive results—largely due to strong farmer-to-farmer networks, organisation and the dissemination of knowledge through participatory sharing organisations.

The Cuban Association of Agricultural and Forest Technicians (ACTAF) was a key component of this agroecological movement, providing training and extension based on their research

activities. This research and technical advice was coupled with strong peasant organisations such as the National Association of Small Farmers (ANAP) and the Campesino-a-Campesino (farmer-to-farmer) Agroecology Movement (MACAC).

During the ‘Special Period’, large farm estates were also redistributed as Basic Units of Cooperative Production (UBPCs) which gave usufruct rights to farmers who were previously workers of state farm enterprises. Small family farms that own their own land also established Credit and Service Cooperatives (CCSs) in which family farms collaborate and group together to achieve economies of scale in marketing harvests, obtaining credit and sharing equipment, knowledge and practices. Landless peasants also joined together to form Agriculture Production Cooperatives (CPAs) in which all assets, including the land, are owned collectively (Rosset et al., 2011).

From 2000 to 2003 MACAC spread to all Cuban provinces as a nationwide farmer-to-farmer network in affiliation with ANAP, CPAs and CCSs. In 2009, about one third (110,000) of family farmers had joined MACAC, with an additional 12,000 farmer-promoters, 3,000 facilitators and 170 coordinators (Rosset et al., 2011). MACAC has proven to be one of the most effective participatory farmer networks and has allowed farmers to access support services and expert advice and share production practices in an inclusive framework.

Family farms in Cuba occupy just 25 per cent of total arable land and produce over 65 per cent of the domestic food supply (Altieri and Toledo, 2011). Depending on the region, it is estimated that 46–72 per cent of small family farms use agroecological techniques. Not only have studies shown that agroecological farming systems are more productive—feeding 15–20 people per hectare per year—but they have also proven to be more resilient during natural disasters.

After Hurricane Ike swept over the island in 2008, agroecological farms suffered damage levels of around 50 per cent, while monocultures were nearly completely destroyed at levels of 90–100 per cent (Altieri and Toledo, 2011).

Furthermore, Cuba has also been a leader in urban agriculture. An estimated 383,000 urban farms cover 50,000 hectares of urban landscape and produce over 1.5 million tons of vegetables. These urban farms, registering top yields of 20 kg/m<sup>2</sup> are not only extremely productive but are also using otherwise unused land for productive food security measures (Altieri and Toledo, 2011).

The Cuban experience of agroecological production is very different from that of Brazil. The ‘Special Period’ forced small farmers to transform their agricultural practices as a matter of necessity. Farmers and technicians came together to share experiences, expertise and innovative ideas with strong supportive organisations and networks. In Brazil the government’s policy framework for family farming supports agroecological practices, but not in any exclusive or favoured manner. Brazil’s framework also encourages industrial agriculture—based on external/chemical-dependent inputs—much more than agroecology-based practices. Brazil’s policy framework for supporting family farmers, as shown in Table 2, does provide an opportunity for the government to encourage agroecological practices with an incentive structure emphasising this type of production. The growing support among rural labour organisations is also beginning to encourage pro-agroecology policies and incentives for such practices.

#### IV. State and Societal Challenges and Policy Implications for an Agroecological Food System

To implement an effective agroecological food system at the local and national levels, the state and societal actors must be proactive. The challenges include high degrees of organisation and using social capital to create vibrant, participatory environments. With support and investment from the state, peasant organisations and networks can build an effective agroecological food system, but many challenges exist. The two country case studies examined exemplify some of the key policy pathways that can be implemented to encourage and support an agroecology-based farming system.

First, the participatory nature of agroecological systems requires inclusive, community-oriented arenas for networking and sharing techniques. Localised **farmer-to-farmer networks** are extremely important for the dissemination of information between farmers in similar agroecological zones. Highly organised peasant organisations are crucial for the success of this interactive, knowledge-sharing, peasant-led alternative. This requires establishing, encouraging and supporting farmer-to-farmer networks such as AS-PTA, ABA, ANA and MST in Brazil and ANAP and MACAC in Cuba. Numerous other networks around the world, such as La Via Campesina, consisting of 148 organisations in 69 countries, are essential for the dissemination of knowledge. These socially inclusive environments allow farmers to share their regional expertise in a participatory mode of learning.

**Table 3**  
Change in Crop Production and Agrochemical Use in Cuba

Crop	Percentage production change		Percent change in agrochemical use
	1988–1994	1988–2007	
General vegetables	-65	+145	-72
Beans	-77	+351	-55
Roots and tubers	-42	+145	-85

Source: Altieri and Funes-Monzote, 2012.

Through the advancement of these participatory networks, working groups and knowledge-sharing initiatives, **gender empowerment** should be prioritised. Identifying discrimination against women in agricultural policies is an important issue.

The United Nation's Special Rapporteur to the Right to Food, Olivier de Schutter, has noted that despite the numerous obstacles faced by women in rural areas, gender issues are incorporated in less than 10 per cent of development assistance in agriculture. Moreover, women farmers receive just five per cent of agricultural extension services worldwide (de Schutter, 2011).

Programmes such as Brazil's ATER Sectoral Policy for Women can work to address this bias through an agroecology-based framework. Through these participatory initiatives and practices, women can be further empowered through socially inclusive policies and programmes.

Equally as important as peasant participation and networking are the **infrastructure and support services** available to rural livelihoods. Smallholders and cooperatives pursuing agroecological practices must have the proper infrastructure and support services to work, use their resources effectively and efficiently and access local markets. Key services such as infrastructure (roads, electricity and irrigation systems) and extension and access to credit, insurance and distribution channels are necessary components to support rural smallholder livelihoods.

In Brazil and Cuba, support for family farmers through credit access programmes (PRONAF, CCS), technical assistance (ATER, ACTAF, CAC), insurance (SEAF, Garantia-Safra, PGPAF) and access to channels of distribution (PAA, PNAE, CPA) are critical components of an agroecology-based farm system. To further encourage a national model of agricultural development based on agroecology, these policies and programmes could offer increased incentives for agroecological practices and offer programmes of credit access, technical assistance, insurance and distribution channels exclusively for agroecology-based family farmers.

Of particular importance is the need for **market access**. The conventional agro-industrial model practised today is dominated by a few large corporations controlling the distribution channels between farmers and consumers—shaping the current food system like an hourglass.

These intermediaries more often than not purchase crops at (unfair) low prices and sell them to consumers at unfair (high) prices. This exploitation should be co-opted by the government by replacing private intermediaries with state-run marketing and distribution agencies. Market access programmes such as Brazil's PAA and PNAE provide family farms with guaranteed market access. Other programmes such as the Family Farm Seal and PGPAF give family farms guaranteed price support for their crops and recognition as a family farm producer. These government-subsidised food programmes could easily be adjusted to further encourage agroecological farming practices by offering better prices for agroecology-based production.

As emphasised throughout, agroecology is a knowledge-intensive practice. This requires **investment in research and education** and the dissemination of that research and know-how to farmer-to-farmer networks. Prioritising agroecology as a model for rural development will also lessen dependence on highly expensive industrial agriculture inputs such as chemical-based pesticides and fertilisers, as well as genetically modified (GMO) seeds. Redirecting this investment to applied research, education and developing innovative technologies with the help of farmers, scientists, academics, agricultural economists and other experts in the field will create a vibrant environment for new developments and knowledge-sharing.

A global food system which leaves one in seven people hungry every day is unacceptable. It is clear that the way in which we produce and distribute food today is not only ineffective at feeding the world's population, it is destroying our natural environment and using natural resources at unsustainable rates. However, there is a solution gaining ground which has proved to be successful at the local level.

The agroecological food system has proven to be productive, resource-conserving, socially inclusive and highly sustainable. Agricultural policies directed at local-level agroecological development will have long-lasting, highly contagious positive effects for local populations and increase food security in a sustainable manner.



1. See, for example, Altieri, M. and Nicholis, C. (2005). *Agroecology and the Search for a Truly Sustainable Agriculture*. Mexico, UNEP; Food and Agriculture Organization (FAO) (2007). 'Sustainable Agriculture and Rural Development (SARD); Policy Brief 11. Rome, FAO; International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) (2008). Summary for Decision Makers of the Global Report approved by 58 governments in Johannesburg, April 2008. Washington, DC, IAASTD; de Schutter, O. (2010). Report submitted by the Special Rapporteur on the right to food, Olivier De Schutter, United Nations Human Rights Council, 16th session, agenda item 3. New York, United Nations General Assembly.
2. See, for example, Pretty, J. N., Noble, A. D., Bossio, D., Dixon, J., Hine, R. E., Penning de Vries, F. W. T. and Morison J. I. L. (2006). 'Resource-Conserving Agriculture Increases Yields in Developing Countries', *Environmental Science and Technology* 40 (4), 1114–1119; and Pretty, J. et al. (2011) 'Sustainable Intensification of African Agriculture', *International Journal of Agricultural Sustainability*, 9 (1).
3. For a thorough review of agroecology as a concept, science and practice, see Wezel et al. (2009). 'Agroecology as a science, a movement and a practice: a review', *Agronomy for Sustainable Development*, Vol. 29, 503–515.
4. The 'inverse relationship between farm size and output' is widely recognised by agricultural economists; see Barret, C. (1993). 'On Price Risk and the Inverse Farm Size–Productivity Relationship', Staff Paper Series no. 369. Madison, WI, University of Wisconsin-Madison, Department of Agricultural Economics; Ellis, F. (1993). *Peasant Economics: Farm Households and Agrarian Development*, 2nd Edition. Cambridge, Cambridge University Press; Rosset, P. (1999). 'The Multiple Functions and Benefits of Small Farm Agriculture in the Context of Global Trade Negotiations', *FAO/Netherlands Conference on the Multifunctional Character of Agriculture and Land*. Oakland, CA, FoodFirst; Deninger, K. (1999). *Making Negotiated Land Reform Work: Initial Experience from Columbia, Brazil and South Africa*. Washington, DC, The World Bank; Binswanger, H. P., Deininger, K. and Feder, G. (1995). 'Power, Distortions, Revolt and Reform in Agricultural Land Relations' in J. Behrman and T.N. Srinivasan (eds), *Handbook of Development Economics*, Volume III. Amsterdam, Elsevier Science B.V.
5. See Table 1.
6. A family farm is predominantly operated by a family and can be no greater than four fiscal modules (Law No. 11,326 of 24 July 2006).
7. See, for example, Holt-Gimenez, E. and Shattuck, A. (2009). *Smallholder Solutions to Hunger, Poverty and Climate Change*. Oakland, CA, ActionAid International and FoodFirst.
8. For more information, refer to document discussing a National Policy for Agroecology available at <http://www.agroecologia.org.br/temas-prioritarios/politicas-publicas-com-enfoque-agroecologico/Documento%20subsidiario%20da%20ANA%20Politica%20Nacional%20de%20Agroecologia%20fev%202012.doc/view>.

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