etc group
action group on erosion, technology and concentration

Communiqué

November 2009 Issue #102

Questions for the Food and Climate Crises

November 2009

ETC Group

www.etcgroup.org

Summing Up the Difference – Chain vs. Web

By 2050, or much sooner, we will be growing food under climatic conditions we've never seen before and learning that "normal" weather is an illusive fiction. Yet, we are told that global land grabs and plantations of agrofuels are a "win-win." The truth is that policymakers don't know enough about our food supply. We don't know where our food comes from and we don't know who is feeding the hungry today. We have absolutely no idea who will feed us in 2050. This report raises more questions than answers. It begins with a comparison of the likelihood of the industrial food chain and the peasant food web getting us through climate chaos.

The Industrial Food Chain

Ninety-six percent of all recorded food and agricultural research takes place in industrialized countries and 80% of that research is on food processing and retailing. Over the last half-century, the industrial food chain has consolidated so that each link in the chain – from seed to soup – is dominated by a handful of multinationals working with an ever-narrower commodity list that has left half of humanity either dangerously malnourished or overweight.

The industrial food chain focuses on far fewer than 100 breeds of five livestock species. Corporate plant breeders work with 150 crops but focus on barely a dozen. Of the 80,000 commercial plant varieties in the market today, well over half are ornamentals. What remains of our declining fish stocks comes from 336 species accounting for almost two-thirds of the aquatic species we consume. Along with the loss of diversity has come a loss of quality. The nutritional content of many of our grains and vegetables has dropped between five and 40% so that we have to eat more calories to get the same nutrition.

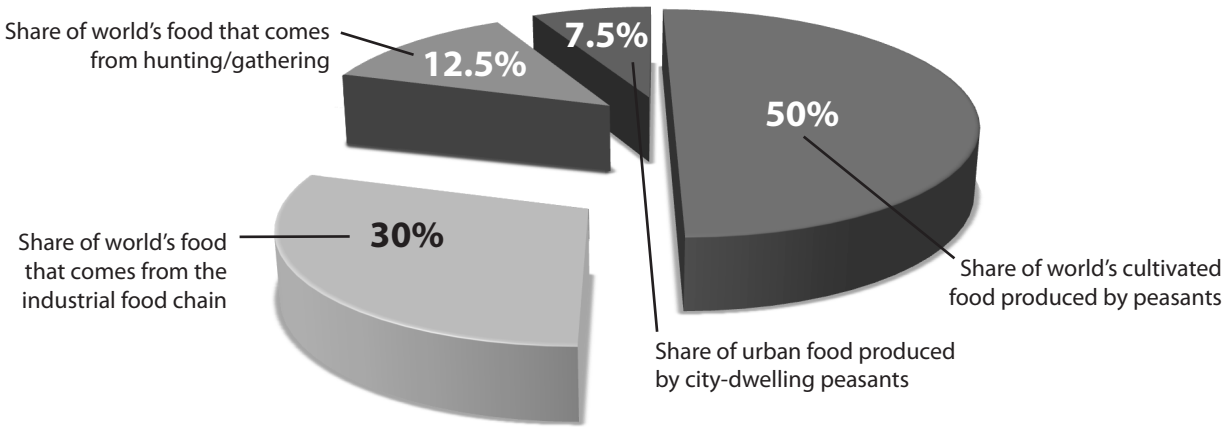
In the face of climate chaos, the industrial chain is imposing a patent regime that prizes uniformity over diversity and enforces a technological model that costs more – and takes more time – to breed one genetically-engineered variety than it does to breed hundreds of conventional varieties. The industrial food chain doesn't know who the hungry are, where they are, or what they need.

The Peasant Food Web

Eighty-five percent of the world's food is grown and consumed – if not within the "100 mile diet" – within national borders and/or the same eco-regional zone. Most of this food is grown from peasant-bred seed without the industrial chain's synthetic fertilizers. Peasants breed and nurture 40 livestock species and almost 8000 breeds. Peasants also breed 5000 domesticated crops and have donated more than 1.9 million plant varieties to the world's gene banks. Peasant fishers harvest and protect more than 15,000 freshwater species. The work of peasants and pastoralists maintaining soil fertility is 18 times more valuable than the synthetic fertilizers provided by the seven largest corporations.

Peasants have not consolidated – but they have organized. There are 1.5 billion on 380 million farms; 800 million more growing urban gardens; 410 million gathering the hidden harvest of our forests and savannas; 190 million pastoralists and well over 100 million peasant fishers. At least 370 million of these are also indigenous peoples. Together these peasants make up almost half the world's peoples and they grow at least 70% of the world's food. Better than anyone else, they feed the hungry. If we are to eat in 2050 we will need all of them and all of their diversity.

Peasants Feed at Least 70% of the World's Population



On the Food and Climate Crises

2009's most important intergovernmental meeting on the climate and food crises has already happened. In October, as climate negotiators were fighting in Bangkok and as the UN food agencies were jousting over a restructured response to the food crisis and plans for the World Food Summit, the Food and Agriculture Organizations's (FAO) Commission on Genetic Resources met quietly in Rome to review the preparedness of the international community to adapt and develop crops, livestock, aquatic and microbial genetic resources used in food and agriculture to address climate change. The meeting also considered the political and corporate constraints that could prevent a major strategic shift to achieve our food security. The Rome Food Summit in November and the Copenhagen Climate Summit in December should pay attention. At stake is the answer to the most important question not being asked in Copenhagen, "Who Will Feed Us?"

A Tale of Two Crises: En route to Copenhagen climate change negotiators see agriculture as both a pollutant and an opportunity. It is the source of at least 14% of greenhouse gas emissions, depends on unsustainable fossil fuels, and is the consumer of 70% of the world's annual freshwater supply. Agriculture – including agroforestry – is also an (theoretical) alternative to fossil energy and a potential source of carbon credits – sequestering the gases that it, and other industries, emit. From the perspective of some food crisis negotiators en route to the Food Summit in Rome, agriculture is a vulnerable industrial manufacture and smallholders (peasants) are a nuisance. Both perspectives are distorted. Policy-makers need to be looking at not what agriculture can do for carbon credits, but at who will feed us and protect our planet at a time of compounding chaos.

Climate and hunger? There is a scientific consensus that climate change is a major threat to world food security. Although increased temperatures and even CO_2 emissions could bring some benefits to temperate zones, even in these areas, the increase in extreme weather events, the likelihood of pest and disease migrations, and the reality that the warmer winds could blow over inhospitable rock and tundra, is hardly grounds for enthusiasm. There is no doubt, on the other hand, that climate change will be devastating for tropical and subtropical regions bringing about major crop losses in South and Southeast Asia as well as sub-Saharan Africa. Yield declines of 20% to 40% are anticipated for major food crops in Africa, for example, well before 2050. These regions will also experience even more extreme weather events than temperate zones and will also suffer from pest and disease migrations. A survey of several countries in the global South shows that, at least by the final decades of the 21st century, the most important food crops in these countries will be grown in temperatures they have never before experienced – i.e., the hottest days of the 20th century will be the coldest days of the late 21st century.[1]

As though this were not enough, global fish stocks are also collapsing and many major species may be played out before 2050. Both industrial agriculture and aquaculture are heavily dependent on fossil fuels that are destined to become too expensive and too scarce before the century's midpoint.

There is also agreement that an entirely unprecedented level of international cooperation will be needed if humanity is to avoid mass starvation in this rapidly changing world. There is no agreement on either what needs to be done or who needs to do it.

85% of the world's cultivated food is consumed relatively close to where it is grown.

A Tale of Two Alternatives? Policymakers are being told by industry advocates (quite wrongly) that there are only two choices: We either globalize the Western industrial food chain and embrace a suite of new technologies, or, we cling to the bucolic belief that massively-subsidized and hugely-expensive little organic family farms will suddenly scale up to crank out enough calories to feed the 9.2 billion people expected for dinner in 2050. *This is a false dichotomy. Neither option is grounded in reality.*

Food chain or food web? The industrial agricultural model talks about a food "chain" with Monsanto at one end and Wal-Mart at the other – a linked chain of agricultural input companies (seed, fertilizer, pesticides, machinery) at the start that is attached to traders, processors and retailers. In fact, most of the world's food doesn't follow a chain; food moves within a web: peasants are also consumers who exchange with one another; urban consumers are also peasant producers growing and exchanging food; farmers are often fishers and foragers and their lands exist within an ecosystem with multiple functions. 85% of the food that is grown is consumed within the same eco-region or (at least) within national borders and most of it is grown beyond the reach of the multinational chain.

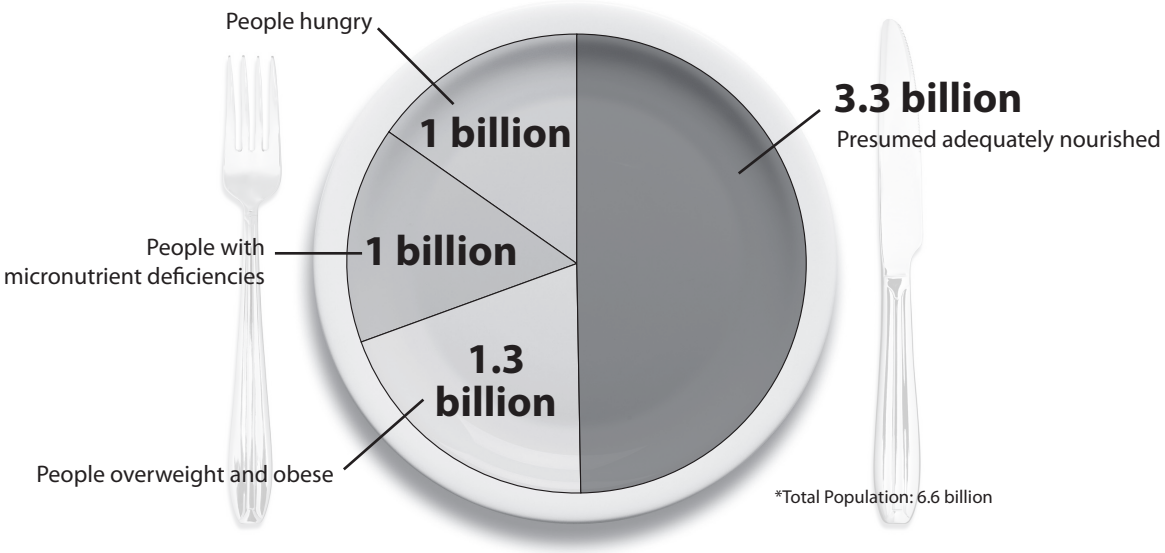
The dominant food system – for most of history and much of humanity still today – is a web, not a chain – of relationships.

The World Bank and many bilateral development agencies have bought into the urban legend that agricultural development can pick and choose the links in the food chain they like. This is naïve. The reason Monsanto, DuPont and Syngenta (which control half the proprietary commercial seed supply and about the same share of global pesticides) are focused on breeding crops like maize, soybeans, wheat and (now) rice is because the big processors like Nestlé, Unilever, Kraft and ConAgra can manipulate these cheap carbohydrate fillers (the four crops account for two-thirds of U.S. consumer calories) into thousands of food (and non-food) products that can "bulk up" more expensive goods. The processors, in turn, are scrambling to meet the exigencies of consumer-attuned retailers like Wal-Mart, Tesco, Carrefour, and Metro that demand cheap, uniform and predictable products on their shelves and show no hesitation to reach back down the food chain to dictate how farmers (and which farmers) will produce food.

"Small scale food producers are those men and women who produce and harvest field and tree crops as well as livestock, fish and other aquatic organisms. They include smallholder peasant/family crop and livestock farmers, herders/pastoralists, artisanal fisherfolk, landless farmers/workers, gardeners, forest dwellers, indigenous peoples, hunters and gatherers, and any other small scale users of natural resources for food production." – Michel Pimbert[3]

Through a shared corporate culture and shared markets, different parts of the food chain have developed strong informal bonds: there are close links between Syngenta and Archer Daniels Midland, for example, and between Monsanto and Cargill and between DuPont and Bunge.[2] *The industrial model comes with chains attached. Buying into any part of it means buying into all of it.*

At Least Half of the World's Population is Badly Served by Today's Food Production Systems*



But, who will feed us? Answering this question first requires an understanding of who "we" are now and how we might change en route to 2050. Then we need to understand the conditions under which food will be provided in the decades ahead. Once we have this sorted out, we can evaluate the likelihood of different production models meeting our future needs. We must not assume that any of the existing models will be adequate. One of the most important findings in this report is that neither the chain nor the web is prepared to confront climate change.

Who are the hungry and how are they changing? At the height of the media surge around the 2008 food crisis, for the first time in history, half of the world's population became "urban." The predictions being written into policy are that, in 2050, two-thirds of the planet's projected 9.2 billion people will be living in cities and that all of this increase (2.6 billion) will be not only in the global South but also in the South's urban areas. Between now and 2050 at least 1.3 billion people will (policymakers are told) migrate – be migrated – from country to city in the largest land grab (or enclosure) ever. Left behind will only be those too old to move and the indigenous peoples determined to stay. The best that can be done for the world's 1.5 billion peasant farmers (again, policymakers are being told) is to buy them one-way bus tickets to the city so that the land can be cleared for a "carbohydrate economy" that churns out "biomass" – food, fodder or fuel and, especially, carbon credits – where and as needed.

The food crisis has increased the ranks of the "hungry" (i.e., those taking in insufficient calories for daily living) from 840 million around 2003 to just over 1 billion today – a jump of 160 million in less than six years. Another billion people may have enough calories but are malnourished – in chronic ill-health due to micronutrient shortfalls.[4] Of the world's 6.6 billion in 2009 then, close to one-third are suffering from hunger and malnutrition. But, there are another 1.3 billion people – overweight or obese – who are also "malnourished."[5] Although this last 1.3 billion elicits less sympathy, many of them are the victims of predatory commercial practices that condemn them to cheap, calorie-rich, nutrition-poor processed foods. *By any measure, almost half the world's population is badly served by today's food production systems.*

There are at least 370 million indigenous peasants on at least 92 million farms.

Where are the hungry, and who is feeding the hungry and malnourished now?

Despite a plethora of official statistics, there is considerable ambiguity about where the hungry can be found and who is feeding them. Nine hundred and fifty million (95%) of the "hungry," it is assumed, live in the global South.[6] Three-quarters (712 million) are said to be "rural."[7] Meaning that 238 million live in towns and cities.[8] This rural/urban imbalance among the hungry (three quarters rural, one quarter urban) needs further study. There is no doubt, however, that government policies are forcing a rapid exodus from the countryside into the cities. The very scale and speed of the transition works against food security and leads to a substantial under-estimation of the urban food problem. The 712 million rural hungry are significantly less cash-dependent than their urban counterparts and have greater access to land and livestock and to the fish and forest products that can be crucial to adequate calories and reasonable nutrition. Meanwhile, the 238 million urban hungry are spending between 60-80% of their income on food – about one-third more than people in rural areas – and getting fewer calories to boot. But, a surprising proportion of the urban hungry also manage roof top/back gardens and livestock pens, where they grow a critical share of their own food and sell to local markets. The UNDP conservatively estimates that some 800 million people are actively engaged in urban food production. Nevertheless, when food prices start to climb, urban peasants often begin trekking back to the countryside.

Peasants currently manage over half of the world's arable land.[9] (See annex.) From regional data, it is fair to estimate: 17 million peasant farms in Latin America grow between a half to two-thirds of staple foods; Africa's 33 million peasant farms (mostly female-led) account for 80% of farms and most of the domestic food consumption; Asia's 200 million peasant rice farms produce most of its harvest.[10] Although their well-being fluctuates sometimes tragically, and they survive under harsh conditions with little external support, the 1,520 million peasant farm family members mostly feed themselves. The 712 million rural hungry (who can't afford to buy much of their food in the industrial food chain's markets) likely depend on peasants for whatever food they have. There are another 1.1 billion in the rural South who may not be

Peasants?

"The language around us is changing all the time. Historically, we were peasants. Then when that term came to mean 'backward' we became 'farmers.' In these days 'farmer' has the connotation of inefficiency and we are strongly encouraged to be more modern, to see ourselves as managers, business people or entrepreneurs capable of handling increasingly larger pieces of territory. Well, I am a farmer and I am a peasant. I learned that I had much more in common with peasants than I did with some of my agribusiness neighbours. I am reclaiming the term peasant because I believe that small is more efficient, it is socially intelligent, it is community oriented. Being a peasant stands for the kind of agriculture and rural communities we are striving to build."

– Karen Pedersen, past-president, National Farmers Union (Canada)[12]

"This debate in the literature...is a fabrication at a higher level, by those who know more. In the countryside, out there, there is no such debate. We continue being peasants. That's the way it is."

– Emiliano Cerros Nava, an executive commission member of UNORCA in Mexico[13]

hungry but also have limited access to the industrial chain and who are also likely to rely heavily on peasant surpluses as well as their own hunting, gathering and gardening.

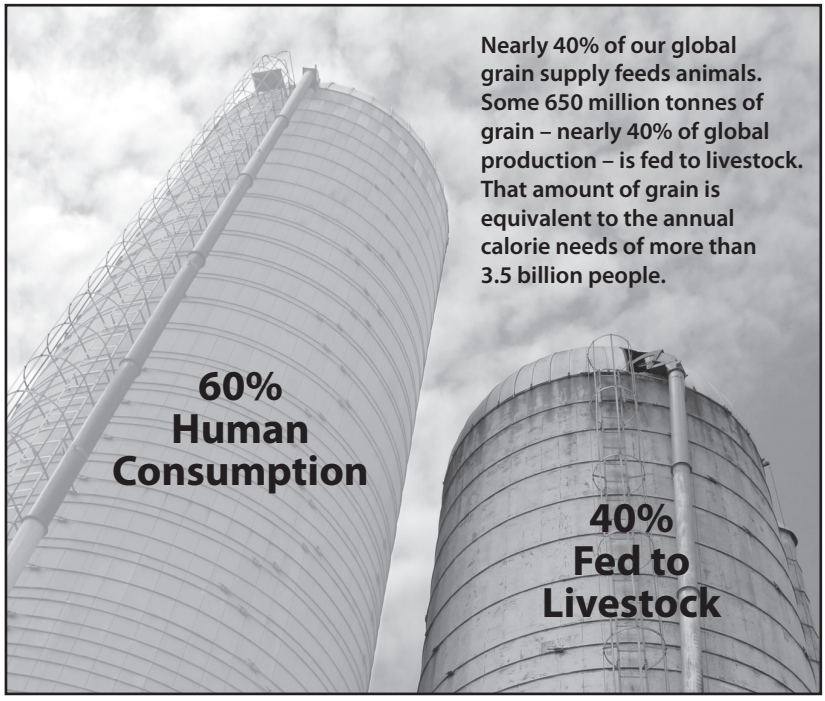
Peasants are also the ones who feed the hungry. Rural peasant production is closest to the 712 million rural people who make up three-quarters of the world's hungry. These people are not only rural but also remote and impoverished or, in other words, of little interest to the industrial chain that prefers middle-class urban markets. Meanwhile, urban peasants grow at least a quarter of the food in the South's cities – the food that is most accessible to the 238 million hungry people who can't afford high food prices. By these estimates, at least 70% of the world's population is fed by peasants.[11]

Policymakers must re-examine the common fallacy that, even when properly-supported, the world's peasant food network lacks the bounty, efficiency and resilience to confront the food and climate crises. At the same time, policymakers must deconstruct the mythology surrounding the effectiveness of the industrial food system. The reality is that the world's 3 billion or so indigenous and peasant producers rural and urban, fishers and pastoralists not only feed a majority of the world's people and most of the world's malnourished, they create and conserve most of the world's biodiversity and are humanity's best defense against climate change.

As we prepare for 2050, then, logic suggests the need for policies that will make it possible for rural people to remain rural and for urbanites to grow as much of their own food as possible.

The bottom line for both Rome and Copenhagen is that in the middle of a crisis – do no harm! Do nothing to disrupt the existing sources of food security. This means safeguarding peasant farms, respecting their resource rights, guaranteeing access to uncultivated lands, and protecting/promoting urban gardens.

Total Grain Supply Distribution



What do we need to do to ensure food security?

If we can't be sure what will grow well where, and if we are sure that extreme weather events will disrupt the food supply much more than in the past, then the central policy questions for shaping a sound food system become clear:

1. How can we ensure that food production for human consumption is given priority over other consumption demands?
2. How can we increase the species diversity of plants, livestock and aquatic species in order to adjust to changing climatic conditions?
3. How can we protect and improve the genetic diversity within plants, aquatic species and livestock to withstand extreme weather events, new pests and diseases, and changing climates?
4. How can we encourage breeders to reset goals to develop diverse and reliable plants and animals?
5. How can we protect and improve biological controls and soil nutrients to safeguard food and reduce reliance on synthetic chemicals?
6. How can we strengthen local community food production to reduce energy dependence and increase food quality?
7. How can we minimize loss and waste throughout the food system?
8. How do we ensure that food is nutritious, adequate, appropriate, and accessible to all?
9. How do we guarantee that peasant producers have stable and equitable production and marketing arrangements?

QUESTION 1

How can we ensure that food production for human consumption is given priority over other consumption demands?

Because climate change means that we can't be sure what will grow where or with what consistency, common sense dictates that – if we don't know otherwise – we have to assume that land and natural resources already support endangered livelihoods and that changes in use should not be permitted in the absence of study and consultation (i.e., if we don't know – don't change it). We must operate on the assumption that marginalized rural populations have a high dependence on non-cultivated biomass (roadsides, forests, savannas, marine and freshwater species, etc.) and that marginalized urban and peri-urban populations have a high food production dependence on all accessible urban soils and water. And, despite our focus on food, we must recognize that both rural and urban peasants also produce other survival essentials such as community fuels, fibres, shelters and medicines.

Climate-ready failures: In October 2008, GRAIN first exposed the new "land grab" in the global South, a rush to control overseas farmland, led by corporate investors and governments.[14] Nowhere is this development more foolhardy than in sub-Saharan Africa. A recent report coordinated by Bioversity International warns that climate-induced crop losses in this region could be as high as 50% just 10 years from now.[15] By 2050, the report says, the majority of African countries will be experiencing "novel" growing conditions on most of their crop land.[16] "Novel" doesn't mean good. Overwhelmingly, Africa will be hotter, drier and more exposed to extreme weather events than any time in the past century. The hotter Sahelian countries, the study says, will have climates with few analogs for any crop (meaning that they have no place to look today for the breeding material they will need tomorrow). Nevertheless, some of these countries like Sudan, Cameroon, and Nigeria – major land grab targets – actually have crop areas that are analogs to many future climates. Not only are they unlikely to be able to help themselves but, also, their potentially valuable germplasm is poorly represented in major gene banks. If large areas are sown to uniform export crops, this unique genetic diversity may become extinct before it can be collected. Such land grabs not only threaten national food security but they endanger the future food security of many other (including OECD) countries.

Lamb grab: Another growing (but reversible) threat to our land-use is from grain-fed livestock production. Forty percent of our global grain supply feeds animals.[17] Forty-seven million hectares are sown annually to fodder grasses and legumes. The protein and calorie loss in feeding crops to cattle, rather than food to people, is massive. UNEP (United Nations Environment Programme) calculates that the loss of calories by feeding cereals to animals instead of using the cereals as human food represents the annual calorie need for more than 3.5 billion people.[18] Despite this, policy-makers are told they must anticipate a 3% per annum rise in meat and dairy consumption. Such a dietary shift is unhealthy and unsustainable as well as unacceptable given the climate changes ahead. The logical policy response is to invest in educational and regulatory initiatives that encourage consumption of more grains, vegetables and fruits.

This is not to suggest that peasant livestock production doesn't have a role. The UN Framework Convention on Climate Change (UNFCCC) sees livestock as a prominent source of greenhouse gas (GHG) emissions while the negotiators addressing the food crisis often look upon peasant livestock keepers and pastoralists as either a disease threat or a barrier to agrofuel production. In reality, peasant livestock systems (mobile or sedentary) can be extremely efficient at enriching biodiversity and in sequestering greenhouse gases. While industrial livestock operations are the leading emitter of nitrous oxide, most extensive livestock systems (i.e., smallholder) are climate friendly.[19] Peasant herds logically occupy the slopes and soils not suitable for crops. These grazing lands cover over 45% of the earth's surface – 1.5 times more than forest. While forests may add only about 10% to their biomass each year, savannas can reproduce 150% and tropical savannas have a greater potential to store carbon below ground than any other terrestrial ecosystem.[20] Manure, generated by peasant livestock holds, when deposited on fields and pastures, doesn't produce significant amounts of methane. By contrast, factory farms produce manure in liquid form releasing 18 million tonnes

of methane annually.[21] The peasant web is agro-ecologically sound – the industrial chain is not. The obvious solution to curtail nitrous oxide and methane emissions generated by industrial livestock is to shut down factory farm production.[22]

Agrofuels: Policymakers are frequently told that there is plenty of unused, marginal land to grow biomass crops (for agrofuels, bio-electricity and bio-chemicals) in the global South. This self-serving argument is nonsense – especially when no one knows how our crops and livestock will withstand climate change. Many of the plants now being established for bio-energy production on plantations in Africa, Asia, and Latin America have been sparsely studied and their performance and environmental-impact is unknown. *Jatropha curcas*, a small tree native to Latin America, is being planted over large areas of Ethiopia, Mozambique and Tanzania and each country expects to produce 60,000 tons of agrofuel by 2017. Some of the most commonly introduced fuel/biomass crops, *Jatropha curcas* among them, are believed to have a very narrow genetic base as well as production problems. No matter what plant species is employed, agrofuels/biomass plants compete with food crops for land, water and nutrients.[23] Governments and corporations do not have the right to take this risk. By encouraging biofuel production, governments are failing to meet their obligations on the progressive realization of the right to adequate food.[24]

The absurdity of growing biomass for export (not for local community use) in Africa is overwhelming. Maize is one of Africa's most important and preferred food crops. It is also a major first-generation agrofuel. In parts of East Africa, however, peasants are abandoning maize for crops that are more suited to drier conditions such as sorghum and millet even though stover production – used for either feed or fuel – is substantially lower. Yet European governments in pursuit of climate carbon credits are pressing for greater agrofuel/biomass production in Africa.

Hidden harvest: So-called underutilized lands are the "commons" from which rural and peri-urban peasants collect and manage medicinal plants, fuel, as well as fish, game, uncultivated vegetables, nuts, fruit, and fungi. The "hidden harvest" not only provides irreplaceable nutrients in their diet, it is also essential for food security. Collection of "wild" and uncultivated materials takes place throughout the year but can become critical for survival in the weeks or months leading up to harvest when family food stocks are lowest. In some areas of Africa, wild resources cover up to 80% of household food needs during staple crop shortages.[25] Even when the annual proportion of the hidden harvest seems low, its availability can mean the difference between life and death. Turning the commons into a global link in the industrial food or fuel chain could massively increase food insecurity.

For example, peasant communities in Borneo routinely gather nourishment from 800 different plants and more than 100 species of ground fauna along with hundreds of bird species. Only a third of their diet comes from cultivated crops.[26] During the rainy season in one region of Kenya, women draw 35% of their plant material (for food, fibre and medicines) from so-called "marginal" lands. Other peasants in Kenya draw a quarter of their annual food supply from the 'wild' but their dependence rises to almost half during the dry months. Peasant women in Uttar Pradesh, India, derive almost half their income from forest species. Even middle-class women in the same region obtain a third of their income from the same source. In one semi-arid region in India where common lands have declined between a third and a half since the 1960s, peasants still derive 14–23% of their nourishment from 'wild' plants and animals. In drought years, this vital harvest can rise to half of their food intake. The Mende of Sierra Leone take more than half their food from forests, streams and fallow fields. In sum, it is safe to estimate that no less than 15% of the annual food supply of rural peasants in the global South comes from lands and life that the peasants nurture – but don't cultivate and that economists don't calculate.[27] *But the most important reality for rural peoples and policymakers is that the absence of this 15% of the food supply in the weeks before crop harvests could mean mass starvation.*

Urban harvest: Urban peasant food production may be even more substantial. According to one estimate cited by Canada's International Development Research Centre (IDRC), 25% of the entire global food output is grown in cities.[28] Undertaken before the recent food crisis, it is likely that this figure significantly underestimates the current level of urban food production. History shows that urban agriculture production rises with food prices. Some years ago, UNDP estimated that at least 800 million urbanites produce some of their own food, including at least 200 million urban families that sell some of their

produce in local markets.[29] Again, these figures are probably much higher today. Almost 18% of the land in downtown Hanoi is used to grow food.[30] In Quito, about 35% of urban land is used for agriculture and in the Argentinan city of Rosario, 80% of the land grows some food. In Abomey and Bohicon, two cities in Benin, half of the population in the peri-urban area is growing food as their primary activity.

Urban food production is a second "hidden harvest" that is usually overlooked or opposed by city and national administrations but is vital to local food security. As multinational hypermarket chains spread throughout the cities and towns of Latin America, Asia, and now Africa, urban production is seen as competition and the city water and sanitation regulations are sometimes employed to destroy the competitors. Yet, in the middle of a food crisis and with climate change all around, every effort must be made to strengthen city farming. Urban gardening and livestock keeping would benefit from policies that promote sound farming practices and safeguard water and soil quality.

The industrial food chain seems to be unaware that not less than 15% of the food critical to the rural hungry and perhaps 25% of the food critical to the urban hungry lies outside the conventional agricultural system. This being the case, how can they protect food security? How is it that the industrial chain can deny the importance of these unconventional food webs? And, most importantly, how can policy-makers – at a time of food and climate crisis – safeguard and strengthen this web?

Policymakers should consider:

1. Discouraging industrial-scale meat and dairy production and encouraging diets high in grains, vegetables and fruit. This could liberate 40% of the world's grain production, reduce energy consumption through transportation savings and reduce GHG emissions while improving human nutrition and lowering health costs;
2. Rejecting agrofuels/biomass crops except for locally produced, community-based consumption;
3. Prohibiting land speculation and "land grabs;"
4. Strengthening customary use of land and resource rights, while taking special measures to protect women's rights to productive assets;
5. Encouraging urban and peri-urban food production and distribution, again taking into account and supporting the important contribution of women producers.

QUESTION 2

How can we increase the species diversity of plants, aquatic species and livestock in order to adjust to changing climatic conditions?

The history of the industrial food chain is a history of biological reductionism. Over the latter half of the 20th century, the chain has persistently narrowed our capacity to ensure food security. Can the chain reverse its trendline? Can the chain change?

Field: Global crop production concentrates on 12 plant species (including maize, rice, wheat, soybeans, potatoes, sweet potatoes, bananas and plantains, sorghum, cassava, millets, sunflowers and canola). Only about 150 plant species are grown commercially around the world. Peasants have domesticated at least 5,000 plant species, but the industrial food chain uses only 3% of them.[31]

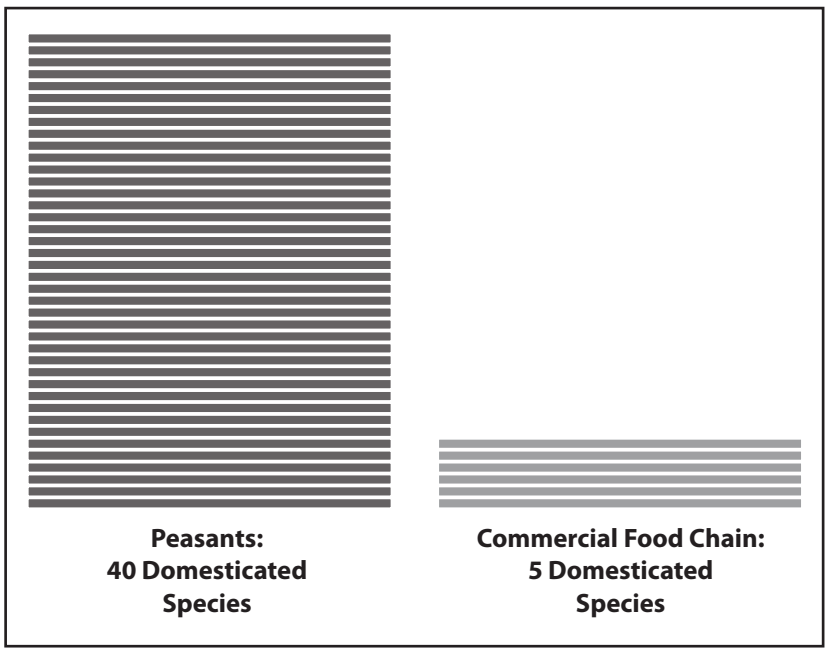
An estimated 640 million peasant farmers and an additional 190 million pastoralists raise livestock for their own consumption and local markets.

Thanks to the ingenuity of farmers, literally hundreds of local plant species have been shown to have remarkable plasticity (e.g., adaptability, resilience) when confronted with extraordinarily different growing conditions including temperature, altitude, photosensitivity, soil conditions and pests and diseases. In harmony with the reductionist trendline (perhaps, understandably, given limited resources), national and international gene banks have also focused on the major global commercial species and have poor collections of the marginalized species that might feed humanity through the climate crisis. Of the 628,000 documented accessions within the Consultative Group on International Agricultural Research (CGIAR) – the largest international gene bank network – for example, nine crops account for more than half of the total collection and two crops – rice and wheat – account for almost one quarter.[32] This means that public breeders don't have access to the ex situ species diversity they need now to prepare for tomorrow. It also means that only the peasant web maintains this species diversity (*in situ*). But, the important message for everybody is that the species that are absent in the ex situ gene bank collections are exposed to genetic erosion in the *in situ* ("on farm") environment.

Fowl: Although peasants have domesticated 40 livestock species, the industrial food chain has concentrated livestock production on just five species (bovines, chickens, pigs, sheep and goats).[33] This shortsighted industrial approach must be reversed if we are to utilize the best species for different slope and soil conditions and new climatic challenges. Our focus must be on the exploration of the 35 livestock species that are largely outside commerce today.[34]

We must also protect, develop and expand beyond the 60 fodder species important to livestock ruminants. Ninety percent of the world's forage grasses originate in sub-Saharan Africa, for example.[35] Forage legumes such as alfalfa, vetch and clover are nearly universal. We need new pas-

Domesticated Animal Species



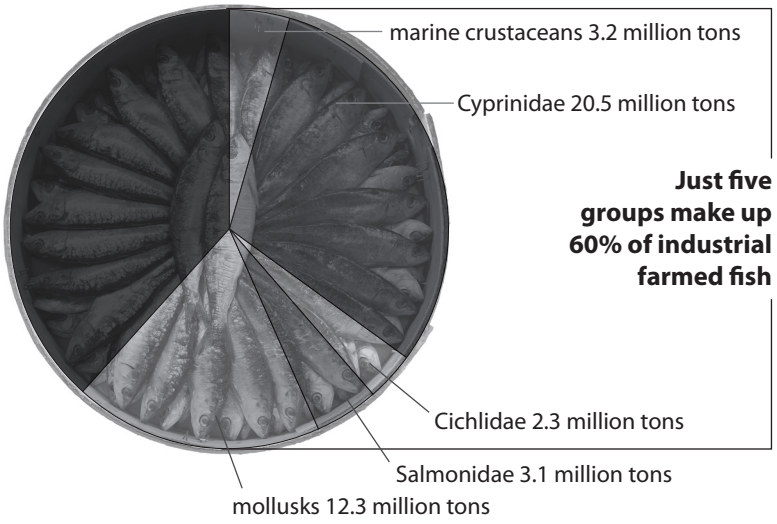
ture species for new conditions. Dependence on a few species increases the risk of food losses in a world of climate chaos.

Fish: Currently, 336 species from 115 families of fish and invertebrates are commercially farmed with 47% of all fish production coming from aquaculture.[36] However, the potential number of edible aquatic species vastly exceeds current use. There are more than 15,200 freshwater species and at least 20,000 marine species. Almost two-thirds of global species consumption (industrial catch) comes from five groups: finfish families (Salmonidae, Cyprinidae and Cichlidae), marine crustaceans and the bivalve mollusks (mussels, clams, scallops, and oysters),[37] which are over exploited and endangered. Tragically, ocean trawlers discard at least 40% of their annual catch. By contrast, coastal and inland fishers use a vastly greater (although uncounted) range of species and discard very little. Freshwater species play an important role in feeding people but the ecosystems in which they live also provide invaluable ecosystem services important to survive climate change. In terms of goods and services, FAO reports, inland waters contribute more to global economies than all terrestrial ecosystems combined, including forests, grasslands and rangelands.[38] The only group that has demonstrated the capacity to monitor and manage either the food stocks and the ecology of inland waters is the artisanal fishers themselves.

The importance of inland peasant fishponds to food security can't be exaggerated. Asian aquaculture, for example, is mostly on peasant farms of less than 2 hectares (ha). Thai freshwater fish ponds are usually less than 0.3 ha but they produce an average of 2,300 kg/ha. Over 90% of Indian shrimp farms are less than 2 ha. Vietnam's tiny catfish ponds still produce 400,000 kg/ha and, backyard water holes in Bangladesh, amazingly, yield substantial quantities of catfish for household diets and local markets.[39] Not only must the small-scale production be protected, it must also be recognized as the basis for strengthening rural and urban aquaculture.

Aquatic Species

Of 35,200 Aquatic Species only 250 Species Found in Aquaculture



Aquaculture Total Catch: 67 million tons

Policymakers should consider:

1. Supporting farmers, livestock keepers and fishers, especially the role of women, in *in situ* conservation and use of diverse local species;
2. Promoting priority market access for underutilized species (aquatic, crop and livestock) that show climate resilience and disease resistance;
3. Encouraging – but only with the approval and oversight of peasants – gene banks, sperm banks, etc., to collect and characterize underutilized species as an urgent national and global priority.

QUESTION 3

How can we protect and improve genetic diversity within plants, aquatic species and livestock to withstand extreme weather events, new pests and diseases, and changing climates?

The genetic diversity within a species can be as extraordinary as the diversity between species. Faced with uncertain and inconsistent conditions on land and at sea, governments must not only explore underutilized species but also encourage genetic diversity within species. Understandably, prior to the recognition of climate change, government conservation efforts focused on the most important plant, livestock and aquatic species (through gene banks for orthodox seed, *in situ* collections for vegetatively propagated plants; cryogenically preserved eggs and sperm, etc.). Collection efforts within the species also concentrated upon yield and uniformity characteristics to maximize profit and meet industrial processing requirements. The food crisis and climate change require a paradigm shift.

> Now, the key words must be *diversity* and *plasticity*.

Field: Thanks to the ingenuity of farmers, the world's major food crops have been encouraged to grow at a remarkable range of altitudes and latitudes in a variety of ecosystems. From early in the 20th century and especially since the 1960s, public and private commercial breeding has narrowed the genetic base of the world's top food crops and massively eroded their genetic diversity. Beginning in the 1960s, the Green Revolution's emphasis on wheat, rice and maize and the focus of commercial breeders on soybeans, alfalfa, cotton and canola (oilseed rape) pushed so-called "poor people's crops" to the margins causing genetic erosion even in low-priority species. By the early 1990s it was roughly estimated that genetic diversity in the world's leading crops was declining by about 2% per annum and that perhaps three-quarters of the germplasm pool for these crops was already extinct. This loss of diversity severely limits the resilience of crops to respond to climate change.

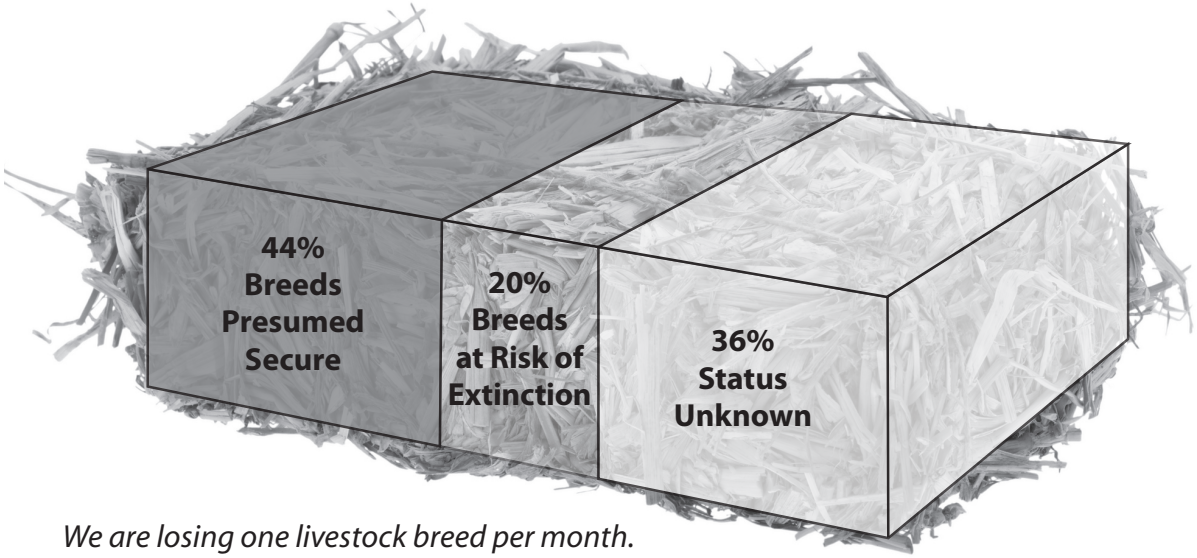
More than the hunger crisis, the climate crisis points to the need to conserve and utilize genetic diversity in both the major food crops and in other crops that show a great potential to be productive while withstanding new pests, diseases and conditions. Who is best able to do this?

Fowl: The world's dominant five livestock species – along with the handful of commercial breeds that dominate industrial production – can be found on every continent except Antarctica. Reports commissioned by FAO warn that climate change may require the mass movement of livestock breeds and express concern that globalization – especially vertical integration along the food chain and standardization trends among the major food retailers – could further narrow the genetic base of commercial species at a time when diversity is needed most.[40] The report specifically warns that new developments in biotechnology will combine with retail standardization to adversely affect small livestock keepers and their ability to conserve livestock genetic diversity.

The lack of genetic diversity within the five commercial livestock species is astonishing – and the loss is accelerating. While 21% of all livestock breeds are thought to be endangered, not enough is known about another 36% to determine their condition. Ten breeds are becoming extinct every year. Among the five livestock species an average of just five breeds dominate commercial production around the world. Leading the cattle herd is the Holstein-Friesian dairy breed (128 countries). The White Leghorn chicken is found almost everywhere. The Large White pig is farmed in 117 countries. Marino sheep, with derivatives, is probably in more than 60 countries, and the Saanen dairy goat can be found in 81 countries.[41] Artificial insemination in the 1960s, embryo transfer in the 1980s and embryo sexing in the mid-1990s encouraged the overuse of a handful of superior animals for millions of progeny. Although the result has been a major increase in productivity, the consequent genetic uniformity, combined with genetic erosion, could spell disaster down the road.

Who can help us conserve and utilize livestock genetic diversity to meet new climatic challenges? To date, the industrial food model has encouraged uniformity, destroyed diversity and increased vulnerability. Is there any evidence that it can change? Avian

Total Number of Animal Breeds Worldwide: 7,616



We are losing one livestock breed per month.

influenza and Mexican swine flu (H1N1) are just two recent examples of global pandemics largely provoked by extreme genetic uniformity in commercial breeds raised in confined and crowded conditions. Genetically uniform and intensively-raised livestock are much more vulnerable to disease and climate change. Peasant-bred breeds are more diverse and more resilient but because they tolerate diseases that kill their more fragile

To protect those livestock breeds that have been bred weak, we are culling those that have been bred hardy – rendering the genetic traits of the hardy extinct.

cousins in the industrial food chain, industry and governments cull (i.e., exterminate) these hardy breeds at the first sign of problems rather than building upon the sturdier stock to withstand new threats.

A handful of companies control livestock genomics and production. Out front is Tyson Foods (USA), which operates in 90 countries and is the world's largest processor and marketer of chicken, beef and pork. The company – with annual sales of $27 billion[42] – is also one of the four global corporations that control broiler genetics.[43] Among others: EW Gruppe in Germany is the world's top breeder in broilers, chickens and turkeys and provides the genetics for 68% of white egg layers and 17% of brown egg layers.[44] Hendrix Genetics (Netherlands) ranks first in the worldwide supply of brown egg layers, second in turkey genetics, fourth in broilers and number two in pig genetics. The company sells layer hen breeding stock in over 100 countries.[45]

This level of corporate concentration represents a direct threat to our long-term food security.

What can we hope for from the peasant web? Livestock keepers and pastoralists are breeding all 40 domesticated species and, according to FAO, are currently protecting 7,616 breeds. If we are going to have the kind of livestock we need for the soils and slopes best suited for livestock-keeping, it would be better to work with those who have the practical incentive, animal germplasm, ecosystem knowledge, and breeding experience to do the job.

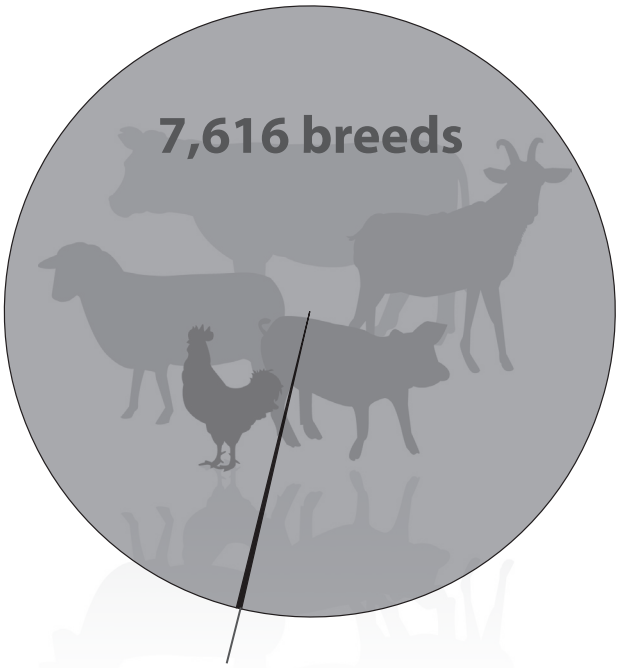
Fish: The world's marine fish stocks are already in rapid decline.[46] Freshwater species are equally suffering from industrial and agricultural pollution and the barriers erected by the world's 45,000 dams. Strains of salmon, shrimp, oyster, carp and tilapia are found almost everywhere. From its possible origins in the Danube River, carp is now harvested in 96 countries. Nile tilapia is native to West Africa and the Nile River but is grown in 61 countries on all continents today. Tiger shrimp are farmed in 23 countries in the Indian and Pacific oceans. Pacific oysters originated in Japan and are now harvested in 31 countries. Atlantic salmon were originally native to both sides of the North Atlantic. Today's Atlantic salmon are grown in at least

19 countries and Chile is one of the world's most important exporters.

Despite their geographic diversity, many commercial species have an extraordinarily narrow – and narrowing – genetic base. Most experts agree that so-called "wild" carp no longer exist but there is some genetic variability in escapees derived from domesticated varieties. The salmon farmed in 19 countries is based upon a single Norwegian breeding program that has been privatized into a company called Nofima.[47]

So, who will best steward our fisheries through climate change? The industrial food chain that jettisons all but a handful of species and whose breeding programs have increased uniformity and vulnerability? Or, the tens of millions of inshore and freshwater fishers who welcome species diversity and know how to protect fragile ecosystems?

Peasants protect 7,616 breeds of 40 livestock species.



Commercial food chain uses an average of 5 breeds for each of the five livestock species.

Policymakers should consider:

1. Eliminating industrial farming/fishing subsidies and adopting regulatory systems that encourage genetic diversity among plant, animal and aquatic food species;
2. Supporting the conservation of endangered genetic diversity first through *in situ* collections and, secondarily, *ex situ* collections, with the permission and guidance of peasants;
3. Prioritizing the conservation and enhancement strategies of peasant producers and orienting conservation programs in gene banks etc., to meet their breeding requirements.

How can we encourage breeders to reset goals to develop diverse and reliable plants and animals?

Perhaps it's hard for the industrial food system to be innovative when it is caught up in chains. For all its vaunted research investment, the industrial model has yet to develop and introduce a single new crop or livestock species (although there are at least 80,000 higher-order plants and many hundreds of mammals, birds and aquatic species potentially available). The uncertainties of climate change demand a complete rethink of our research (and especially breeding) priorities. Plant breeders need to nurture species and genetic diversity in the field during the same growing season.

Rights make a wrong: The major legacy of the industrial agricultural research chain will be the creation of intellectual property rights over crops, livestock and fish (including their genetic parts and components). Attempts to monopolize plant varieties began in the 1930s but grew into a global force in the 1960s with the formation of an International Convention for the Protection of New Varieties of Plants (UPOV). In order to assert legal ownership over living material, breeders abandoned diversity and marginalized agronomic priorities in order to develop varieties that were "distinct, uniform and stable." These are the mirror opposites of what we need today and tomorrow. Physical distinctiveness may help defend ownership in court, but it is not necessarily beneficial in the field. If it doesn't serve an economic purpose, breeders' efforts to achieve distinctiveness simply means a waste of time and

Institutional Breeders vs. Peasant Plant Breeders

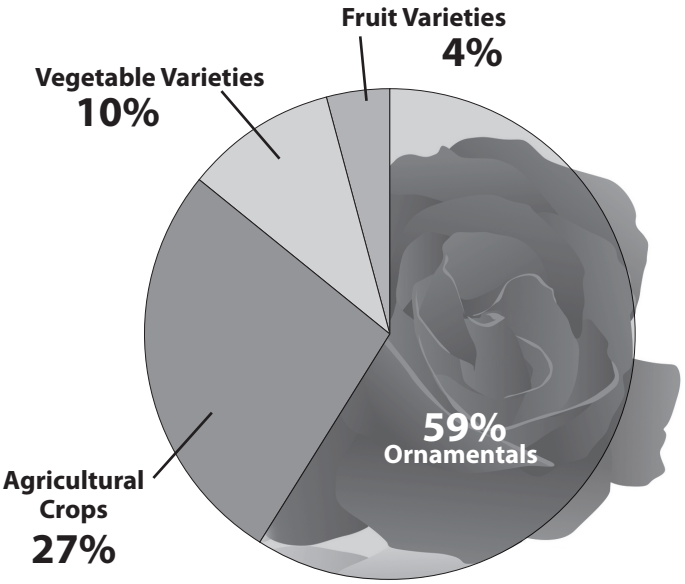
money. The industrial food chain prizes uniformity and stability. But these attributes fight against climate readiness and food security. Today, our crops and livestock desperately need genetic diversity, not uniformity. While we don't want "unstable" varieties and breeds, we do want "plasticity" – the genetic capacity of plants and animals to respond rapidly to changing conditions. Replanted seed adapts over generations to local agronomic conditions and offers higher and more reliable yields. Both patents and related regulations are forcing farmers to buy new – and, therefore, unadapted seed – every season, denying agriculture one of its most important tools. Any restrictions on the right to conduct research using patented breeding material must be struck down since it blocks peasants from their customary breeding activities.

We need as many breeders and as much diversity as possible. *Intellectual property regulations are a direct attack on global food security.*

Can the industrial chain breed for diverse conditions? In fact, the research food chain isn't even very good at breeding with readily-available genetic diversity. In 2007 there were over 72,500 proprietary plant varieties (including ornamentals) ostensibly available in the marketplace.[48] And, over the last 40 years, Green Revolution plant breeders have released 8,000 new crop varieties.[49]

By contrast, since the 1960s peasants have bred far more than 1.9 million plant varieties. We know this because peasants have donated that number of unique farm-bred varieties

Plant Variety "Patents"
Issued by the European Community's Plant Variety Office
by Category (1996-2009)



to the world's gene banks. But, since the gene banks have mostly been looking for the major crop species, some of the most important peasant plant breeding has been ignored. As already discussed, peasants grow thousands of plant species annually and at least 103 of these species each contributes 5% or more of the human calories available in one or more countries. If policymakers are informed by the track record, it is clearly peasant farming systems that are the proven leaders in using genetic diversity to help crops withstand climate change.

Lab Lobotomy? Even if we revoke monopolistic intellectual property regimes, can we reorganize conventional agricultural research to address these new breeding goals? The second legacy of the agricultural genetic-engineering industry will be its fragmentation and privatization of the crop improvement system established one hundred years ago. University training is now oriented to molecular biology and combinatorial technologies designed to identify and transfer genes between species. Graduates have no real understanding of plant breeding or agriculture. Today's institutional plant breeders and taxonomists are yesterday's news – themselves a dying breed. For example, FAO's 2006 assessment of plant breeding capacity in Africa shows less support for plant breeders today than in 1985, noting that, "local plant breeding programs are generally poorly funded, including funds for field trials, staff travel, data analysis and infrastructure."[50] In the U.S., the number of public sector breeders working on fruit and vegetable crops declined by 43% from 1994-2001.[51] At the moment when taxonomy, conventional plant breeding, and a holistic sense of ecosystem adaptation are vital to withstand climate change, the biosciences have given themselves a frontal "labotany."

Since the 1960s peasants have bred far more than 1.9 million plant varieties.

Cash crunch: Can we afford to make the shift from the industrial breeding strategy toward a more diversified approach? The third legacy of the agbiotech industry is the entrenchment of an extraordinarily slow and expensive research model. Corporate wastefulness at the breeding end of the food chain is already damaging to food security. According to Monsanto, it takes at least 10 years and between $100- $150 million to introduce a new genetically modified trait into plant varieties.[52] One public researcher reports that it took 16 years to introduce the well-known and well-characterized *Bt* trait into GM crops.[53] This is in contrast to conventional, commercial breeders who rarely spend more than $1 million to breed a plant variety. (DNA marker assisted breeding technologies can speed the pace of conventional breeding.) In short, for every new biotech variety, conventional breeders can introduce between 100 and 150 standard varieties – in less time. Despite this, the world's largest seed companies are working almost exclusively on GM seeds.

Let them eat chrysanthemums? If data from the European Plant Variety Protection Office accurately reflects the orientation of the world's industrial food chain, then the chain is having trouble getting its priorities sorted. Fully 59% of all the plant variety "rights" granted between 1995 and 2009 went to ornamental species (notably roses and chrysanthemums) while only 27% went to agricultural varieties that feed people or livestock and just 14% went to vegetables and fruits over a time period in which the ranks of the hungry swelled by more than 160 million.[54] The UPOV registry of protected plant varieties includes more than 29,000 roses and chrysanthemums – almost exactly the count for wheat, rice and maize combined.

It took Monsanto 16 years and $100-150 million to introduce maize with a *Bt* insect-resistant trait.

The bottom line critique of industrial plant and livestock breeding is that it focuses on too few species, the wrong species and the wrong breeding goals. It is also too slow, too expensive, and its dependence on intellectual property forces the development of varieties that exacerbate climate vulnerability.

The peasant breeding system creates vastly more varieties of many more species that has as its primary goal ecosystem adaptability and yield reliability. However, this in no way means that the peasant web will manage climate change without consequences. Peasants, too, will experience growing conditions they have never seen before and they will need to work with novel species and breeding material in order to survive. There is a desperate need to encourage germplasm exchanges between and among peasant organizations around the world, and to insure that they have priority access to whatever gene bank materials they need.

See-through systems? Some public (institutional) breeders – while acknowledging their situation and limitations – can't see how they can get "there" from "here." How is it possible to work with so many species for so many environments? How is it possible to work with peasants? To do so will require a social re-organization of scientific research. However, peasant organizations have never been better prepared to meet these challenges. Communications technologies make it vastly easier to maintain a constant exchange of research information between all the concerned parties. Conventional public researchers and

In the early 1980s, the seed industry trade group, ASSINSEL,[55] lobbied strenuously for worldwide adoption of plant breeder's rights (patent-like protection for corporate plant breeders). ASSINSEL's booklet, ***Feeding the 500 Million****, argued that breeders' rights would be essential to stimulate plant breeding and feed the world's hungry. Thirty years later, corporate breeders have patented more ornamentals than food crops. And the 500 million hungry have more than doubled in number. Let them eat roses and chrysanthemums!*

peasant breeders could and should be able to work together.

Today's climate change emergency should also encourage policymakers to consider a "tried-and-true" participatory breeding strategy that brought tremendous plant diversity to a range of new ecosystems in one country. Between the 1860s and 1920s, the U.S. Department of Agriculture annually mailed millions of small packets of experimental seeds to farmers throughout the United States.[56] Farmers in much of the country were breaking sod for the first time and there were few certainties about growing conditions. The initiative was highly successful. Tens of thousands of farmers/plant breeders produced their own varieties, exchanged seed with their neighbors, and turned their country into a breadbasket. *Today, national and international gene banks should follow USDA's example, multiply appropriate seed stocks[57], and – working with peasant organizations – send small packets of experimental seed to producers around the world.*

Policymakers should consider:

1. Reorienting breeding programs to ensure both seasonal and long-term species and genetic diversity;
2. Promoting "bulk population" breeding strategies for developing materials that can withstand extreme weather events;
3. Eliminating intellectual property regimes or unnecessary phytosanitary regulations that privilege genetic uniformity;
4. Prohibiting any measures – public or private – that constrain the right of peasants to save or exchange food genetic resources;
5. Introducing a seed multiplication program through gene banks to distribute experimental seed packets to peasant organizations for distribution to interested members.

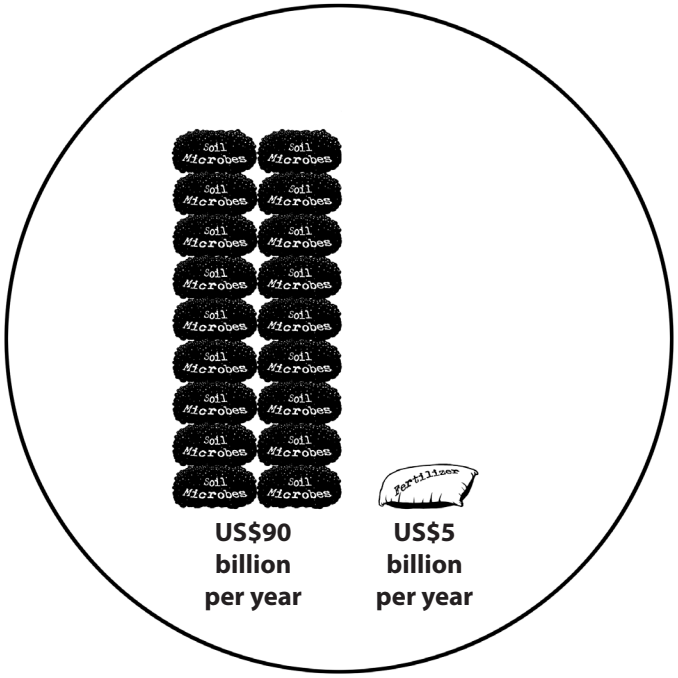
How can we protect and improve biological controls and soil nutrients to safeguard food and reduce reliance on synthetic chemicals?

Peak oil meets peak soil: As we struggle to feed the world in the decades ahead, we either will not have – or will not be able to afford – fossil carbon to drive farm machinery or to provide synthetic fertilizers and pesticides. Studies suggest, however, that pests and diseases will migrate around the world putting new pressures on productivity. Even in the regions expected to benefit from climate change (northern USA, Canada and much of Western Europe) increased temperatures and CO_2 levels portend a boom in rusts, blight and insects – and, most worryingly, a speed up in the pace of disease and insect mutation. Microbes play a crucial role in climate mitigation. Soil organic matter, as FAO points out, is the major global storage reservoir for carbon (not forests).[58] Microbe diversity turns this material into soil nutrients beneficial to crops and contributes to climate regulation and stabilization. An estimated 140-170 million tons of nitrogen, for example, are fixed by microbes worldwide annually – equivalent to US$90 billion worth of nitrogen fertilizers. (By comparison, the big seven fertilizer companies have total annual sales of less than $5 billion.[59]) The use of synthetic fertilizer is a major contributor to emissions of nitrous oxide in agriculture.

Global fertilizer production has risen more than 31% since the World Food Summit of 1996 and is expected to climb further with the expansion of the industrial food chain's promotion of agrofuels and the removal of cellulose fiber from fields. Already, fertilizers account for 1.2% of total GHG emmisions – equivalent to the total emissions from countries like Indonesia or Brazil.[60]

Monocultures of genetically uniform crops deplete microbial diversity while increasing crop vulnerability. The best way to ensure that beneficial microbe diversity maintains soil nutrients is to promote the species and genetic diversity already discussed.

The Value of Microbial Diversity



Microbial diversity in peasant farmers' soil fixes nitrogen worth $US90 billion per annum. By contrast, the world's seven giant fertilizer corporations have annual sales of less than $US5 billion.

Policymakers should consider:

1. Expanding public research on the beneficial use of microbes for soil fertility and as biocontrol agents;
2. Working with peasants to monitor beneficial microbe environments as well as the advance of new pests and diseases;
3. Through regulation and education, encourage moves away from dependence on fossil carbons.

QUESTION 6

How can we strengthen local food production to reduce energy dependence and increase food quality?

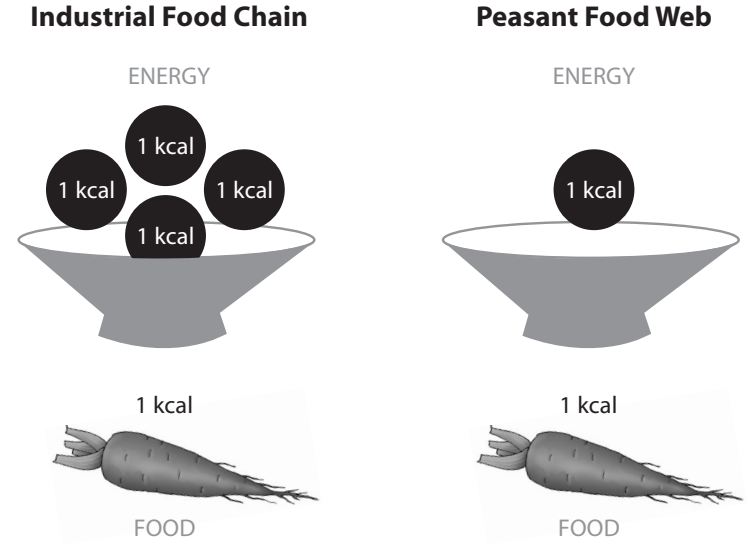
Can the industrial food chain be made more efficient and effective? The total energy in the food system in OECD states is approximately 4 kcal invested to supply 1 kcal of food, while in the global South, the ratio is approx. 1 kcal invested to supply 1 kcal of food.[61]

If you live in an OECD country there is an almost automatic assumption that the whole world is part of a globalized food chain. This is entirely wrong. It bears repeating that 85% of the world's cultivated food is grown and consumed domestically (i.e., if not within sight of the farm, at least within the same country or eco-region).[62] The percentage of world food sold through the industrial food chain is uncertain but likely includes almost all of the 15% that is exported across national borders and the vast majority of food marketed in OECD countries.[63]

It is equally likely that the majority of the world's food does not depend upon industry-based agricultural inputs. In 1996, for example, FAO estimated that 1.4 billion people depend upon farm-saved seed. That figure roughly equaled the total number of peasant farmers at that time. While peasants may occasionally purchase seed or fertilizer or pesticides, the majority (either by choice or necessity) produce their food without external inputs. In other words, "conventional" food production is not industrialized while "unconventional" production is dependent upon a globalized industrial system. *The web is much bigger than the chain.*

Setting aside small farm production, at least 15% of the global South's consumed food in rural areas isn't cultivated[64] and at least 25% of its urban food is grown by urban-dwelling peasants who are not associated with the industrial food chain.[65] Conservatively, then, at least 20% of the global South's food supply comes from the uncalculated "hidden harvest" of rural and urban production. This figure must, at the very least, be added to the productivity of peasant farmers[66] and pastoralists. In other words, not less than 70% of the South's food supply is the work of peasants.

Energy Consumption: Industrial Food Chain vs. Peasant Food Web



OECD countries = 4 units of energy to produce 1 unit of food

Global South = 1 unit of energy to produce 1 unit of food

Policymakers should consider:

1. Making urban and peri-urban food production a national priority;[67]
2. Developing special breeding initiatives intended to support urban agriculture;
3. Supporting peasant-based food production and facilitating direct peasant-consumer marketing arrangements, with special attention to the role of women;
4. Encouraging organic production.

How can we minimize loss and waste throughout the food system?

Waste to waist: The industrial chain is enormously wasteful. Food spoilage in the industrial food system's markets is higher (+/-30%) because of distance, time, storage, and other wasteful (including consumer) practices.[68] One study estimates that U.S. households throw out 1.28 lbs. of food a day in their trash (14% of all meats, grains, fruits and vegetables coming into the home), the equivalent of $43 billion worth of food.[69] On top of that, commercial retail food establishments (convenience stores, fast food, groceries) throw away 27 million tons of food annually.[70]

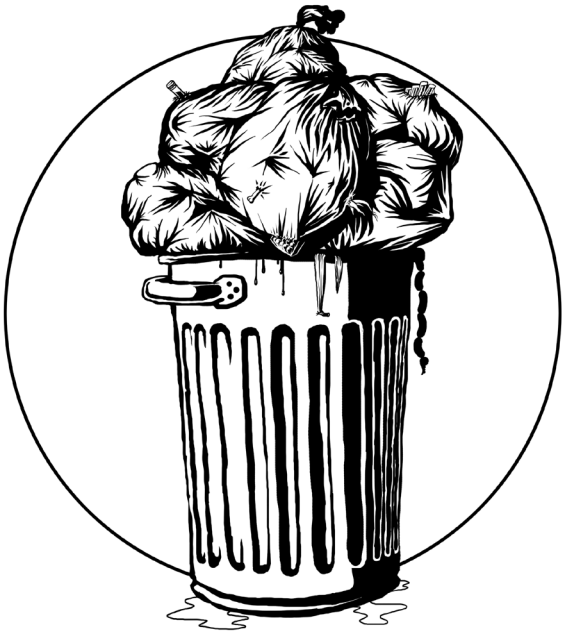
Even recognizing that the majority of the world's hungry live in tropical or sub-tropical areas where food losses – from field to fork – are often devastating, the industrial food chain – mostly in temperate climes with better storage – is unconscionably wasteful. A 2009 industry survey of the most efficient UK food supply chains concluded that on average, 20% of costs in the chain add no value.[71]

Of the 3,900 calories available to the average U.S. consumer daily, 1,100 calories are wasted.

During the World Food Summit in November 2009, the US National Institute of Diabetes and Digestive and Kidney Diseases reported that, since the previous food crisis of 1974, US food wastage had risen from 28% to 40% of the country's total food sup-

U.S. households throw away an estimated US$48 billion of food each year

That is 14% of all meats, grains, fruits and vegetables coming into the home. Waste is defined as food that is discarded, even if it's perfectly good to eat. Total food waste in U.S. is an estimated US$90-100 billion per year.



Nutritional losses in industrial food chain: declines of 5% to 40%

ply – an average per capita waste of 1,400 kilocalories a day (nationally, 150 trillion kilocalories a year). This figure does not take into account the calorie loss from turning grain into meat and dairy products or from wasting good food on fat waists. The environmental damage is also substantial: the unnecessary consumption of more than 300 million barrels of oil a year – and a quarter of the US freshwater supply – to make food that goes uneaten.[72]"

As a result of breeding for high yields and factory farming practices, U.S. and UK data show that essential nutrients in the food supply have declined in recent decades, with double-digit percentage declines of iron, zinc, calcium, selenium, etc. A 2009 study reports declines of 5% to 40% or more in some minerals in vegetables and fruits.[73] Fewer nutrients per serving translate into less nutrition per calorie served. Fast-growing plants tend to dilute nutrient concentrations.[74] In addition, high levels of nitrogen fertilizers reduce nutrient density and flavour. Similarly, Green Revolution wheat varieties bred for higher yields contain diminished protein content.[75]

When the industrial food chain moves south, the waste and the expense come along with it. On average, the South's urban consumers spend at least 30% more on food than rural consumers and, still, their average calorie intake is lower.[76] Studies show that poor urbanites spend as much as 60-80% of family income on food – and that their lack of cash translates more directly into food shortages and malnutrition than for their country cousins.[77] It is hard to see how the industrial food chain can shake off its wasteful habits. Eighty percent of all research on food and agriculture concentrates – not on farm-based food production – but on food processing and retailing.[78] And 96% of this research takes place in OECD countries. Despite industry's attempts to make the chain more efficient and profitable, the losses and abuses are staggering.

Policymakers should consider:

1. Reducing post-harvest losses (including consumer waste) as an important strategy for food security;
2. Recognizing and reversing industrial breeding strategies that diminish essential nutrients of food crops.

How can we ensure that food is nutritious, adequate, appropriate, and accessible to all?

After decades of consolidation, the world's largest grocery retailers occupy the most powerful position on the agroindustrial food chain. The top 100 global food retailers – with sales of US$1.8 trillion in 2007 – account for 35% of all grocery sales worldwide.[79] The top 3 mega-grocery retailers – Wal-Mart, Carrefour and Tesco – account for 50% of the revenues earned by the top 10 companies. In a single decade, Latin American markets saw the same level of supermarket penetration that took five decades in US and Europe. The pace of market penetration continues in Asia, and now Africa.

In South Africa, four supermarket chains control 94.5% of the retail food market.[80] The country's 1,700 supermarkets (most of which have been established since 1994) have displaced an estimated 350,000 "spazas" (Mom 'n Pop food shops).[81] Giant grocery retailers also have major impacts on the other end of the food chain – buying or contracting with farmers. Wal-Mart says it will buy from more than one million Chinese farmers by 2011.[82] Retail giants (including Tesco, Metro, Carrefour, Wal-Mart) advise governments on WTO compliance and *codex alimentarius* regulations.[83] The impact of food retailers on diet and obesity is undeniable. In Guatemala, for example, a proudly indigenous country and homeland to global crops like maize and beans, the expansion of supermarket chains has been especially damaging to the nutrition of poor consumers who are pressed to buy cheap, highly-processed pastries, cookies and crackers instead of their native staples. A 2007 study found that a 1% increase in supermarket purchases translates into a 41% decline in maize calorie consumption and a 6.5% falloff in bean consumption.[84]

Policymakers should consider:

1. Regulatory incentives to protect and enhance local markets, local production and consumption;
2. Before allowing the entry of global retail food giants: examine the social and economic impacts of oligopolistic retail food markets, including potential impacts on peasant food producers (both rural and urban), the survival of small businesses in the formal and informal sectors, and the nutrition and diets of poor consumers;
3. Insuring that food retailers do not exploit agricultural workers in the global South through labor contracts or procurement standards;
4. Rejecting industry-driven food safety and phytosanitary standards and so-called "sustainable" procurement standards that discriminate against peasant farmers and small-scale businesses.
5. Incorporating the Right to Food in binding law, nationally and internationally.

QUESTION 9

How can we be sure that peasant producers have equitable and stable production and marketing arrangements?

Chain Reaction? There is growing recognition and support for peasant farmers and their role in confronting the food and climate crisis. The first-ever independent global assessment of agricultural science and technology, the International Assessment of Agricultural Knowledge, Science & Technology (IAASTD), sponsored by the World Bank, the Food & Agriculture Organization and other U.N. agencies, warns that the world can't rely on technological fixes – such as transgenic crops – to solve systemic problems of persistent hunger, poverty and environmental crises, and affirms the crucial role of small-scale farmers and low-impact farming.[85] UNEP's February 2009 report, *The Environmental Food Crisis*, calls for a global micro-financing fund to boost small-scale farmer productivity and the development of diversified and resilient eco-agriculture systems that provide critical ecosystem services, as well as adequate food to meet local needs.[86] The *Córdoba Call for Coherence and Action on Food Security and Climate Change* asserts that the interests of peasant producers must be at the center of the food and climate debate and that "excessive reliance on market-based approaches is a mistake."[87] The authors of the Call are food and agriculture specialists and include the first and current UN Special Rapporteurs on the Right to Food.

Peasants must take the lead in developing strategies – including technological strategies – to meet the food and climate crises. This doesn't mean abandoning the potential for conventional science. The Western model of science and technology has developed micro-techniques that can have macro applications – high-tech advances that are often widely deployed. By contrast, peasant research often develops macro-technologies for micro-environments – that is, wide-tech and complex, integrated strategies that are location specific. Over the last hundred years – since the rediscovery of Mendel's law – these two scientific solitudes have rarely been integrated. These strategies can only be brought together appropriately when leadership comes from the peasant organizations that are both closest to the land and closest to the hungry. Food sovereignty – the right of nations and peoples to democratically determine their own food systems – is paramount.

Policymakers should consider:

1. Most international agricultural policies dictated by free trade agreements and international financial institutions work against peasant farming systems. These policies have aggravated hunger and contributed to unsustainable farming practices. The seriousness of today's crises demands that policymakers revoke failed agricultural trade policies.

2. Supporting farmers and small producers to remain on the land and maintain their livelihoods through access to land, water, credit and markets. Respect and uphold resource rights, including the right to save and exchange seed and genetic resources. This includes Farmers' Rights, Livestock Keepers' Rights, and "aquatic rights."[88]

3. Supporting proposals for food sovereignty put forth by the world's largest peasant organizations, fishers, pastoralists and other important small producers, environmentalists and consumer networks, in the Nyeleni World Forum for Food Sovereignty, organized in Mali 2007 (see box, at right).[89]

Conclusion

In the final analysis, there is no reason to be sanguine. We are deeply in trouble and there is no guarantee that humanity will rise to the challenges ahead. Neither the industrial food chain nor the peasant web has all that is necessary to get us through our compounding crises. The industrial food chain – rigid, reductionist and centrally-regulated – doesn't have the resilience to respond to the current food crisis or the coming climate chaos. The peasant system – diverse, decentralized, and dynamic – has the natural resources, research capacity and resilience to better meet the challenges ahead. It is not the capacity or competence of the peasant system that we need to worry about, it is the lack of capacity and incompetence of government and science to "scale up" their systems to meet the potential of peasant provisioning.

Six Pillars of Food Sovereignty from Nyeleni 2007[90]

Focuses on Food for People, putting the right to food at the centre of food, agriculture, livestock and fisheries policies; *and rejects* the proposition that food is just another commodity or component for international agri-business.

Values Food Providers and respects their rights; *and rejects* those policies, actions and programmes that undervalue them, threaten their livelihoods and eliminate them.

Localises Food Systems, bringing food providers and consumers closer together; *and rejects* governance structures, agreements and practices that depend on and promote unsustainable and inequitable international trade and give power to remote and unaccountable corporations.

Puts Control Locally over territory, land, grazing, water, seeds, livestock and fish populations; *and rejects* the privatisation of natural resources through laws, commercial contracts and intellectual property rights regimes.

Builds Knowledge and Skills that conserve, develop and manage localised food production and harvesting systems; *and rejects* technologies that undermine, threaten or contaminate these, e.g. genetic engineering.

Works with Nature in diverse, agroecological production and harvesting methods that maximise ecosystem functions and improve resilience and adaptation, especially in the face of climate change; *and rejects* energy-intensive industrialised methods which damage the environment and contribute to global warming.

Annex: Peasants – Counting Up

While statisticians think in terms of 1.5 billion (or so) smallholder farmers, the more realistic figure is probably double that number when full account is taken of the urban gardeners and livestock keepers, nomadic pastoralists, fishers and forest-keepers around the world. Urban gardeners often move back and forth between town and country and fishers often farm as well. Here is a different calculation...

Farmers: Of the 450 million farms, 382 million (85%) have 2 hectares or less and statisticians customarily refer to them as smallholders or peasants.[91] Close to 380 million peasant farms are in the global South meaning that at least 1.5 billion (4 people per farm) live there.[92] Very significantly, 370 million[93] are indigenous peasants on at least 92 million farms. In total, peasants probably have significantly more than half of the world's cropland. Of the global 1.56 billion hectares in arable and permanent crops (many countries classify "peasants" as holding 5 hectares or less), 764 million hectares could be held by peasants and not less than 225 million are held by big farmers. Mid-size farmers would then hold 571 million hectares (or an average of 36.8 ha).[94] In some definitions, some researchers tend to incorporate peasant "farms" that have much less than one-tenth of a hectare per person. The inclusion of these almost-landless peasants into productivity calculations grossly distorts the productivity of most peasant farms.

Pastoralists: An estimated 640 million peasant farmers and an additional 190 million pastoralists raise livestock for their own consumption and local markets.[95] Since pastoralists move about and routinely cross national boundaries, they are seldom included in food security calculations.

Fishers: There are about 30-35 million peasant fishers but probably more than 100 million peasants are involved in fishing, processing and distributing what amounts to half the world's fish caught for direct human consumption (or 30 million metric tons).[96] These figures, however, only speak to peasant production for the market and not the fishing and aquaculture activities of indigenous peoples or rural and urban peasants outside the market. In total, 2.9 billion people get 15% or more of their protein from ocean or fresh water fish. In the poorest countries, 18.5% of protein comes from artisanal (small scale and/or subsistence) fishers.[97] Unlike most commercial fisheries and ocean-going fish factories, peasant fishers focus almost exclusively on fish for human consumption as opposed to fishmeal for livestock feed.

Urban gardeners: Before the current food crisis, an estimated 800 million peasants were involved in urban farming. Of these, 200 million produce food primarily for urban markets and manage to provide full-time employment for about 150 million family members. On average, the world's cities produce about one-third of their own food consumption.[98] In times of high food prices, the amount of urban and peri-urban gardening and livestock-keeping increases significantly.

Hunters and gatherers: It is not possible to quantify the proportion of the food supply that comes from forests, roadsides, and other "marginal" land. We do know that at least 410 million people live in – or adjacent to – forests and derive much of their food and livelihood from forests. In total, 1.6 billion people get some portion of their food and livelihood from forests around the world.[99]

Endnotes

[1] Battisti, David S. and Rosamond L. Naylor, "Historical warnings of future food insecurity with unprecedented seasonal heat," *Science* 9(323), 2009, pp. 240–44.

[2] Ana de Ita of CECCAM, Mexico, is among those who point out the need to monitor the links between dominant players and sectors in the corporate food chain.

[3] Michel Pimbert, *Towards Food Sovereignty: Reclaiming Autonomous Food Systems*, IIED, 2008.

[4] Kennedy, G., Nantel G., and Shetty, P., "The scourge of 'hidden hunger': global dimensions of micronutrient deficiencies," *Food, Nutrition and Agriculture*, No. 32, 2003, published by FAO.

[5] T. Kelly, et al., "Global burden of obesity in 2005 and projections to 2030," *International Journal of Obesity* 32, 1431-1437; published online 8 July 2008.

[6] Ibid., FAO estimates that of the 840 million hungry people in 2003, 799 million lived in developing countries – 95%.

[7] IFAD, "The Rural Poor," Chapter 2 of the *World Poverty Report*, Rome, 2002.

[8] FAO, State Of The World 2007- *Our Urban Future*, "While malnutrition in rural areas is still a bigger problem in terms of actual numbers of people – of the 852 million people worldwide who are undernourished, 75 percent live in rural areas…"

[9] Michel Pimbert, *Towards Food Sovereignty: Reclaiming Autonomous Food Systems*, IIED, 2008, p. 9. "Worldwide, small farms occupy about 60% of arable land."

[10] Philip McMichael, "The Peasant as 'Canary'? Not too early warning signs of global catastrophe," *Development Journal*, p. 5. Miguel Altieri, 2008, in FoodFirst http://www.foodfirst.org/en/node/2115 "At present, small farms (2 hectares and less) produce the majority of staple crops for urban and rural inhabitants across the world - in Latin America 17 million peasant farms produce 51 percent of the maize, 77 percent of the beans, and 61 percent of the potatoes consumed domestically; 33 million small (mostly female--run) farms in Africa, representing 80 percent of the farms, produce a 'significant amount of basic food crops with virtually no or little use of fertilizers and improved seed;' and in Asia most of the rice consumed is produced by more than 200 million small farmers (Altieri 2008)."

[11] Uwe Hoering, *Who Feeds the World?* May 2008, Church Development Service. An Association of the Protestant Churches in Germany (EED) – Evangelischer Entwicklungsdienst, pp.8-9; "…small farms account for an estimated 80 % of the land used for agriculture. With small fields, worked under difficult conditions and with scarce means, these farms contribute nearly half the food that feeds the world…"

[12] Annette Desmarais, *La Via Campesina: Globalization and the Power of Peasants*, Fernwood Publishing, 2007, p. 196.

[13] Ibid.

[14] GRAIN's documents on the land grab are available here: http://www.grain.org/landgrab/

[15] FAO, Commission on Genetic Resources for Food and Agriculture, "The Impact of Climate Change on Countries' Interdependence on Genetic Resources for Food and Agriculture," Background Study Paper No. 48 (Preliminary Version), edited by Sam Fujisaka, David Williams and Michael Halewood, October 2009.

[16] Ibid.

[17] Jan Lundqvist, et al., "Saving Water from Field to Fork: Curbing Losses and Wastage in the Food Stream," Draft for CSD, May 2008, Stockholm International Water Institute.

[18] Nellemann, C., MacDevette, M. Manders, T., Eickhout, B., Svihus, B., Prins, A.G., Kaltenborn, B.P. (Eds.), February 2009. The environmental food crisis – The environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, www.grida.no

[19] Helena Paul, Almuth Ernsting, Stella Semino, Susanne Gura & Antje Lorch, *Agriculture and climate change: Real problems, false solutions*, A Preliminary report by Econexus, Biofuelwatch, Grupo de Reflexion Rural and NOAH - Friends of the Earth Denmark, September 2009, p. 25. www.econexus.info

[20] Ibid.

[21] Ibid.

[22] Ibid., p. 26. As the authors put it, "Industrial livestock intensification is not an option." www.econexus.info

[23] For example, maize in China requires 2,400 litres of water to yield one litre of ethanol. See, International Water Management Institute, "Water Implications of Biofuel Crops: Understanding Tradeoffs and Identifying Options," Water Policy Brief, Issue No. 30, 2009.

[24] Olivier De Schutter, *Analysis of the World Food Crisis By The U.N. Special Rapporteur On the Right*

to Food, New York and Geneva: Office of the United Nations High Commissioner for Human Rights, 2 May 2008. Online at http://www.srfood.org/images/stories/pdf/otherdocuments/1-srrtfnoteglobal-foodcrisis-2-5-08.pdf

[25] FAO, "Diversity of Experiences: Understanding Change in Crop and Seed Diversity – A Review of selected LinKS Studies, Gender, Equity and Rural Employment Division, Rome, 2008, p. 3.

[26] These examples of the importance of uncultivated foods around the world come from: Scoones, Ian, Melnyk, Mary, and Pretty, Jules N. (1992), *The Hidden Harvest, the Role of Wild Foods in Agricultural Systems – A Literature Review and Annotated Bibliography,* International Institute for Environment and Development (London), SIDA/WWF.

[27] The 15% figure is extrapolated from Ian Scoones, et al., 1992. *The Hidden Harvest, the Role of Wild Foods in Agricultural Systems*, published by IIED, and also FAO data on urban gardening.

[28] "Smit et al. (1996) estimate that 15-20% of the global food output is grown in cities." Cited in: International Development Research Centre (2008) *Agriculture in Urban Planning – Generating Livelihoods and Food Security*, edited by Mark Redwood, Earthscan.

[29] FAO, State of the World 2007- *Our Urban Future*, "The U.N. Development Programme estimates that 800 million people are involved in urban farming worldwide, with the majority in Asian cities. Of these, 200 million produce food primarily for the market, but the great majority raise food for their own families. In a survey conducted for the United Nations, cities worldwide already produce about one third of the food consumed by their residents on average…"

[30] Examples from Hanoi, Quito, Rosario, and cities in Benin are from: International Development Research Centre (2008) *Agriculture in Urban Planning – Generating Livelihoods and Food Security*, edited by Mark Redwood, Earthscan.

[31] E. Small and P.M. Catling, "Global Biodiversity – The Source of New Crops," *Biodiversity* 9 (1&2), p. 4.

[32] Consultative Group on International Agricultural Research, System-wide Information Network for Genetic Resources (SINGER), accessed November 2, 2009.

[33] FAO Commission on Genetic Resources for Food and Agriculture, Background Study Paper No. 43, July 2009, "The Use and Exchange of Animal Genetic Resources for Food and Agriculture," FAO Agriculture and Consumer Protection Department (in particular Dafydd Pilling).

[34] According to FAO's Background Study Paper No. 43 (2009), p. 4, the domesticated animal species are: Alpaca, ass, Bactrian camel, buffalo, cattle, chicken, Chilean tinamou, deer, dog, dromedary, dromedary x bactrian camel crosses, duck (domestic), domestic duck x Muscovy duck crosses, goat, goose (domestic), guinea fowl, guinea pig, horse, llama, Muscovy duck, ñandu, ostrich, partridge, peacock, pheasant, pig, pigeon, quail, rabbit, sheep, swallow, turkey, vicuña, yak (domestic).

[35] FAO, Commission on Genetic Resources for Food and Agriculture, "The Impact Of Climate Change On Countries' Interdependence on Genetic Resources for Food and Agriculture," Background Study Paper No. 48 (Preliminary Version), edited by Sam Fujisaka, David Williams and Michael Halewood, October 2009.

[36] FAO, Commission on Genetic Resources for Food and Agriculture, Background Study Paper No. 45, September 2009, "The Use and Exchange of Aquatic Genetic Resources for Food and Agriculture," by Devin M. Bartley, John A.H. Benzie, Randall E. Brummett, F. Brian Davy, Sena S. De Silva, Ambekar E. Eknath, Ximing Guo, Matthias Halwart, Brian Harvey, Zsigmond Jeney, Jian Zhu, Uthairat Na-Nakorn, Thuy T.T. Nguyen, and Igor I. Solar.

[37] FAO, Commission on Genetic Resources for Food and Agriculture, "The Impact Of Climate Change On Countries' Interdependence on Genetic Resources for Food and Agriculture," Background Study Paper No. 48 (Preliminary Version), edited by Sam Fujisaka, David Williams and Michael Halewood, October 2009.

[38] FAO, Commission on Genetic Resources for Food and Agriculture, Background Study Paper No. 45, September 2009, "The Use and Exchange of Aquatic Genetic Resources for Food and Agriculture," by Devin M. Bartley, John A.H. Benzie, Randall E. Brummett, F. Brian Davy, Sena S. De Silva, Ambekar E. Eknath, Ximing Guo, Matthias Halwart, Brian Harvey, Zsigmond Jeney, Jian Zhu, Uthairat Na-Nakorn, Thuy T.T. Nguyen, and Igor I. Solar.

[39] Ibid.

[40] FAO Commission on Genetic resources for Food and Agriculture, Background Study Paper No. 43, July 2009, "The Use and Exchange of Animal Genetic Resources for Food and Agriculture," FAO Agri-

culture and Consumer Protection Department (in particular Dafydd Pilling).

[41] Ibid.

[42] Website of Tyson Foods, Inc. http://www.tyson.com/Corporate/

[43] Susanne Gura, 2007, "Livestock Genetics Companies: Concentration and proprietary strategies of an emerging power in the global food economy, League for Pastoral Peoples and Endogenous Livestock Development. http://www.pastoralpeoples.org/docs/livestock_genetics_en.pdf

[44] Ibid.

[45] Ibid.

[46] The following statistics on fish genetic resources are taken from: FAO, Commission on Genetic Resources for Food and Agriculture, "The Impact Of Climate Change On Countries' Interdependence on Genetic Resources for Food and Agriculture," Background Study Paper No. 48 (Preliminary Version), edited by Sam Fujisaka, David Williams and Michael Halewood, October 2009.

[47] FAO, Background Study Paper No. 48, October 2009.

[48] International Union for the Protection of New Varieties of Plants (UPOV), "PVP Statistics for the period 2003-2007," Document prepared by the office of UPOV, October 19, 2008.

[49] Jan Lundqvist, et al., "Saving Water from Field to Fork: Curbing Losses and Wastage in the Food Stream," Draft for CSD, May 2008, Stockholm International Water Institute, p. 24.

[50] Guimaraes, E. and E. Kueneman, "Assessment of National Plant Breeding and Biotechnology Capacity in Africa and Recommendations for Future Capacity Building," *HortScience*, Vol. 41 (1) February 2006, pp. 50-52.

[51] Paul Gepts and Jim Hancock, "The Future of Plant Breeding," (2006), *Crop Science*, 46: 1630-1634, p. 1633.

[52] Cameron, D., "U.S. Regulators Speed Seed Oversight After Delays," *Dow Jones Newswire*, September 3, 2009.

[53] Goodman, M., "Plant Breeding Requirements for Applied Molecular Biology," *Crop Science*, Vol. 44, November-December 2004, p. 1913-14.

[54] European Union's Community Plant Variety Office. On the Internet: http://www.cpvo.europa.eu/

[55] Assinel was the forerunner to the International Seed Federation.

[56] Fowler, Cary. (2004) *Unnatural Selection: Technology, Politics and Plant Evolution*, Gordon and Breach, p. 16-17. According to Fowler, for example, between 1890-1897 the USDA distributed an average of 10 million packets of seeds to U.S. farmers per year.

[57] Non-proprietary and non-GM, and most of all, under the guidance of peasant farmer organizations.

[58] FAO, Commission on Genetic Resources for Food and Agriculture, "The Impact Of Climate Change On Countries' Interdependence on Genetic Resources for Food and Agriculture," Background Study Paper No. 48 (Preliminary Version), edited by Sam Fujisaka, David Williams and Michael Halewood, October 2009. http://www.fao.org/nr/cgrfa/cgrfa-back/it/?no_cache=1

[59] ETC Group, *Who owns nature? Corporate Power and the Final Frontier in the Commodification of Life*, ETC *Communiqué* #100, November 2008. http://www.etcgroup.org

[60] Kongshaug, G. 1998. Energy Consumption and Greenhouse Gas Emissions in Fertilizer Production. IFA Technical Conference, Marrakech, Morocco, 28 September-1 October, 1998, 18pp.

[61] Pimental, David, "Energy Inputs in Food Crop Production in Developing and Developed Nations," Energies, 2(1), 2009, pp. 1-24. http://www.mdpi.com/1996-1073/2/1

[62] van der Ploeg, Jan Douwe, *The New Peasantries – Struggles for Autonomy and Sustainability in an Era of Empire and Globalization*, Earthscan, 2008, p. 4.

[63] Ibid., p. 290. As an indication, according to van der Ploeg, of the total world production of rice only 6% is traded across borders. In the case of wheat, which is the world's biggest export crop among the cereals, only 17% is exported (page 290). Meat is exported in growing quantities, facilitated by global cooling chains, which allow long-distance trading. Nevertheless, meat exports still represent less than 10 % of total world production. This minor share, however, does not exclude that the total value of global food exports (in 2000) was estimated by the World Trade Organization (WTO) at US$442.3 billion, representing 9 % of world merchandise trade and 40.7 % of world exports in primary products. Over the last 15 years exports of food products have been growing more quickly than total world production (Oosterveer, 2005, pp. I4-16; see also EC, 2006).

[64] The 15% figure is extrapolated from Bishop, Joshua and Scoones, Ian. 1994. "The Hidden Harvest, the Role of Wild Foods in Agricultural Systems," published by IIED, and also FAO and IDRC data on urban gardening.

[65] FAO, State of the World 2007- *Our Urban Future*, "The U.N. Development Programme estimates that 800 million people are involved in urban farming worldwide, with the majority in Asian cities. Of these, 200 million produce food primarily for the market, but the great majority raise food for their own families. In a survey conducted for the United Nations, cities worldwide already produce about one third of the food consumed by their residents on average…"

[66] Joachim von Braun, Director General, International Food Policy Research Institute, "*High and Rising Food Prices*," presentation made to U.S. A.I.D., Washington, D.C., April 11, 2008. The world has at least 450 million farms. Among the large and medium-sized farms, 2.25 million (0.5% of farms) have 100 ha. or more and 65 million farms have between 2-100 ha. Many of these so-called middle sized farmers would likely describe themselves as peasants. In fact, many peasants are inside the industrial food chain – with hundreds of hectares – but are surviving mostly or partly through off-farm jobs. At most, about 268 million people worldwide live on these large and medium-sized farms and may participate in the industrial food chain. http://www.ifpri.org/presentations/20080411jvbfoodprices.pdf

[67] However, we do not advocate inappropriate urban farming proposals such as The Vertical Farm Project. http://www.theecologist.org/blogs_and_comments/commentators/Jim_Thomas/

[68] Nellemann, C., MacDevette, M. Manders, T., Eickhout, B., Svihus, B., Prins, A.G., Kaltenborn, B.P. (Eds). February 2009, p. 29. *The environmental food crisis – The environment's role in averting future food crises*. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, www.grida.no

[69] Jones, Timothy, (2004) "Using Contemporary Archaeology and Applied Anthropology to Understand Food Loss in the American Food System," University of Arizona, Bureau of Applied Research in Anthropology.

[70] Jones, Timothy, 2004.

[71] Joanne Denney-Finch, IGD, OBE Speech to Australian Food and Grocery Council Highlands Conference 2009, 14 May 2009.

[72] *Economist*, "Environment: A Hill of Beans", November 28, 2009.

[73] Donald R. Davis, "Declining Fruit and Vegetable Nutrient Composition: What is the Evidence?" *HortScience*, Vol. 44 (1), February 2009, p. 15-19.

[74] Brian Halweil, "Still No Free Lunch: Nutrient levels in U.S. food supply eroded by pursuit of high yields," published by The Organic Center, September 2007. http://organic.insightd.net/reportfiles/Yield_Nutrient_Density_Final.pdf

[75] Porter, J.R., et al. Wheat Production Systems and Climate, 2007. http://www.isr.qut.edu.au/downloads/wheat_prod_grace_07.pdf

[76] *Women Feeding Cities: Mainstreaming gender in urban agriculture and food security*, Edited by Alice Hovorka, Henk de Zeeuw, and Mary Njenga, Practical Action Publishing Ltd, 2009.

[77] Ibid.

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

[79] ETC Group, *Who owns nature? Corporate Power and the Final Frontier in the Commodification of Life*, ETC *Communiqué* #100, November 2008. http://www.etcgroup.org

[80] Chikazunga D., Joordan D., Biénabe E., and Louw A. (2007) "Patterns of restructuring food markets in South Africa: The case of fresh produce supply chains," AAAE Conference Proceedings (2007), pp. 53-55, Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, South Africa.

[81] Reardon, Thomas A., Timmer, C. Peter, Barrett, Christopher B. and Berdegue, Julio A., The Rise of Supermarkets in Africa, Asia, and Latin America. *American Journal of Agricultural Economics*, Vol. 85, No. 5, pp. 1140-1146, December 2003.

[82] Wal-Mart, 2009 Annual Report, p. 11.

[83] Reardon, Thomas A., Henson, Spencer and Berdegué, Julio,Proactive Fast-Tracking Diffusion of Supermarkets in Developing Countries: Implications for Market Institutions and Trade. *Journal of Economic Geography*, Vol. 7, No. 4, pp. 399-431, 2007. In 2004, for example, when Metro first went into Vietnam, the company started working with the Ministry of Trade "to develop a legal framework to help accession to the WTO."

[84] Abay Asfaw, "Supermarket Purchases and the Dietary Patterns of

Households in Guatemala," IFPRI Discussion Paper 00696, April 2007.

[85] IAASTD. All reports available on the Internet: http://www.agassessment.org/

[86] Nellemann, C., MacDevette, M. Manders, T., Eickhout, B., Svihus, B., Prins, A.G., Kaltenborn, B.P. (eds.), February 2009. *The environmental food crisis – The environment's role in averting future food crises.* A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, www.grida.no

[87] The Córdoba Declaration

[88] See Wilderswil, Declaration on Livestock Diversity, September 11, 2007. http://www.viacampesina.org/main_en/index.php?option=com_content&task=view&id=441&Itemid=1 Community-based fishers are also calling for "aquatic rights" – equity in access to and control over offshore, coastal and inland aquatic resources. See http://www.tambuyog.org/sea_fish_project.asp

[89] See Via Campesina website http://viacampesina.org/main_en/index.php?option=com_content&task=view&id=282&Itemid=38 and www.nyeleni2007.org

[90] As cited in Patrick Mulvaney, "Food sovereignty comes of age," www.foodethicscouncil.org, Volume 2, Issue 3, Autumn 2007, p. 19.

[91] Joachim von Braun, Director General, International Food Policy Research Institute, "*High and Rising Food Prices*," presentation made to U.S. Agency for International Development, Washington, D.C., April 11, 2008. http://www.ifpri.org/presentations/20080411jvbfoodprices.pdf

[92] From van der Ploeg (2008) "Worldwide, there are now some 1.2 billion peasants (Ecologiste, 2004; Charvet, 2005). 'Small-farm households, after all, still constitute nearly two-fifths [1.3 billion] of humanity' (Weis, 2007, p25). In 1996, FAO's *State of the World Report on Plant Genetic Resources* estimated that 1.4 billion people depend on farm-saved seeds. This was an estimate based on FAO's assumption of the number of people living on peasant farms. (Personal communications, Cary Fowler and David Cooper, March 2009.) See also, Oxfam Briefing Paper 129, "Investing in Poor Farmers Pays," (2009). Oxfam estimates that 1.7 billion poor people live on farms in low and middle-income countries accounting for about two thirds of all farmers in these countries. Of these, Oxfam says that 906 million farmers live in areas of substantial production potential.

[93] IFAD, April 2009, "IFAD Policy on Engagement With Indigenous Peoples," Draft Policy for Approval, Executive Board, 97th Session, Rome, 14-15 September 2009. EB 2009/97/R.3/Rev.1

[94] Extrapolated from von Braun. See also, Uwe Hoering, *Who Feeds the World?* May 2008, Church Development Service. An Association of the Protestant Churches in Germany (EED) – Evangelischer Entwicklungsdienst, pp. 8-9: "… small farms account for an estimated 80% of the land used for agriculture. With small fields, worked under difficult conditions and with scarce means, these farms contribute nearly half the food that feeds the world…"

[95] Helena Paul, Almuth Ernsting, Stella Semino, Susanne Gura & Antje Lorch, *Agriculture and climate change: Real problems, false solutions*, A Preliminary report by Econexus, Biofuelwatch, Grupo de Reflexion Rural and NOAH - Friends of the Earth Denmark, September 2009. www.econexus.info

[96] Yumiko Kura, et al., World Resources Institute, "Fishing for Answers: Making Sense of the Global Fish Crisis," Washington, DC, 2004, p. 37.

[97] FAO Draft Text, (2009) "Biotechnology applications in fisheries and aquaculture in developing countries." The draft states: "Capture fisheries and aquaculture supplied about 110 million tonnes of food fish in 2006, providing more than 2.9 billion people with at least 15% of their per capita animal protein." "…in low-income food-deficit countries…the contribution of fish to total animal protein intake was significant – at 18.5 percent – and is probably higher than indicated by official statistics in view of the under-recorded contribution of small scale and subsistence fisheries and aquaculture."

[98] FAO, State of the World 2007- *Our Urban Future*, citing a U.N. Development Programme report.

[99] 1.6 billion people rely heavily on forest for their livelihoods. According to the World Bank, 60 million people live in the rain forests of Latin America, Southeast Asia and West Africa and depend on forests; 350 million people live in, or next to, dense forests and rely on them for subsistence or income, and 1.2 billion people in developing countries use trees on farms to generate food and cash.

ETC Group is an international civil society organization based in Canada. We are dedicated to the conservation and sustainable advancement of cultural and ecological diversity and human rights. ETC Group supports socially responsible development of technologies useful to the poor and marginalized and we address international governance issues affecting the international community. We also monitor the ownership and control of technologies and the consolidation of corporate power.

www.etcgroup.org

ETC Group publications are available free-of-charge on ETC Group's website.
ETC Group welcomes financial support from individuals and organizations to continue our work.
Please go to our website for more information on making a donation.

etc group