

Agro-fuels, food security, and the metabolic rift

Philip McMichael

Introduction¹

Deepening the ecological contradictions of industrial agriculture, agro-fuels substitute a world minority's energy-intensive consumption patterns for »feeding the world«.² The combined crises of peak oil and peak soil legitimize an agro-fuels project, supplementing Northern fuel needs with cheaper (Southern) forms of ethanol and biodiesel, with little effect on the total emissions. Converting rainforests, peatlands, savannas, or grasslands to produce agro-fuels in Brazil, South East Asia and the U.S. »creates a ›biofuel carbon debt‹ by releasing 17 to 420 times more CO₂ than the annual greenhouse gas (GHG) reductions these biofuels provide by displacing fossil fuels« (Fargione et al. 2008).

At present Brazil plans to replace 10 percent of the world's fossil fuels by 2025 with sugar ethanol, Malaysia and Indonesia are expanding oil palm plantations to supply 20 percent of EU bio-diesel needs, India plans 14 million hectares of land for jatropha plantations, and Africa 400 m (Holt-Giménez 2007, Vidal 2007, 3). But this will not address the energy crisis of peak oil. While the UN estimates agro-fuels supplying 25 percent of energy needs over the next 15–20 years, ExxonMobil »projects that biofuels, together with wind and solar, will contribute about 2% of the world's total energy supply in 2030« (Padilla 2007, 3). The International Energy Agency estimates that by 2030 agro-fuels will »barely offset the yearly increase in global oil demand« (Holt-Giménez 2007), and all renewables, including agro-fuels, will amount to only 9 percent of global energy consumption (GRAIN 2007, 6).

At the close of 2007, the *Economist*'s food-price index reached its highest point since originating in 1845, food prices had risen 75 percent since 2005, and world grain reserves were at their lowest (Holt-Giménez/Kenfield, 2008, 3). Estimates of the impact of agro-fuels vary: the FAO argues agro-fuels account for 10 percent of food price rise, while the International Monetary Fund (IMF) and the International Food Policy Research Institute (IFPRI) claim 30 percent, with the World Bank estimating a 65–75 percent contribution (Phillips 2008, Chakrabortty 2008).

Under present circumstances and projections, the agro-fuels project, as solution to the energy and climate crises, promises to deepen these crises as well as the food crisis. Politicians with short-term horizons – driven by the exigencies of a state system needing to renew its legitimacy by stabilizing currencies, consumer/energy prices and employment – appeal to images of »green accumulation« as they mandate emissions targets, and subsidies, that empower the agro-fuel industry. In addition, the corporate/ state nexus is embedded in a fuel-food complex underlying agflation, compounding the conjunction of the three crises. Thus, palm oil »now used widely in food products ranging from instant noodles to biscuits and ice cream, has become so integrated into energy markets that its price moves in tandem with crude oil prices«

(Greenfield 2007, 4). Further, with rising oil prices, »food is worth more as petrol than it is on the table, even if the subsidies are removed« (Goodall 2008).

The growing synchrony of these markets (in oil, palm oil and food in general) registers two fundamental crises (food, climate) associated with industrial agriculture (McMichael 2009). The supreme irony of the agro-fuels project is that it not only exacerbates the former in seeking to address the latter crisis, but also it intertwines them by deepening the »metabolic rift« (the separation of agriculture from its biological base). This interruption of natural cycles of regeneration of soil and water is accompanied by the dispossession of small-farming cultures responsible for local ecological and social reproduction.

Metabolic rift and the agro-fuels complex

The »metabolic rift« arises when agronomic methods abandon agriculture's natural biological base, interrupting the recycling of nutrients in and through the soil and water. Fossil fuels deepen this rift, industrializing agriculture and its use of inorganic fertilizer, pesticides, herbicides and seed varnishes, in an attempt to sustain productivity on a deteriorating ecological base. The industrial food system requires expenditure of 10–15 energy calories to produce 1 calorie of food (GRAIN 2007, 7), contributing 22 percent of greenhouse gas (GHG) emissions (McMichael et al. 2007).

Global warming expresses a »planetary metabolic rift,« interrupting natural processes of sequestration of carbon. A recent study in *Science* concluded that »when the impacts of forestation of land is compared to the impact of growing and using agro-fuels, the forested lands were capable of sequestering anywhere from two – nine times more carbon over a 30 year period« (Smolker et al. 2008, 12). Agro-fuels increase emissions through deforestation and draining peatlands, or remove land from agricultural production, driving up food prices and encouraging expansion of crop lands into pristine habitats, and so on (Monbiot 2008). Mitigation of global warming with agro-fuels is thus akin to pouring fuel on the fire. In Brazil, sugar cane and soy expansion for biodiesel indirectly deforests – by »usurping agricultural lands previously used for other purposes, cane expansion has pushed those other uses, especially cattle-raising, into forest frontier areas« (Smolker et al. 2008, 19). Soy, a new source of biodiesel, is notorious for depleting soils and nutrients, and results in »climate-damaging emissions of nitrous oxide« (Idem). The food-fuel nexus intensifies this – in 2007 ranchers and settlers burned Amazon forest to clear land in Brazil, Paraguay and Bolivia: »rising prices for both cattle and soy for animal feed appear to be the major factor driving the demand for more land« (*Ibid*, 23), as a consequence of the US shift from soy into corn production for ethanol. The Brazilian *cerrado* (a biodiverse woodland/grassland, 20 percent of Brazil) is disappearing faster than the Amazon: »more than half of this biome has already been turned over to cattle grazing and soy production, and it is now being considered as a promising area for sugar cane as well« (*Ibid*, 24). Meanwhile, in Southeast Asia, where Malaysia and Indonesia are the world's largest palm oil producers, supplying about 85 percent of the world market, palm oil expansion stems from tax breaks, subsidies and huge investments ranging from the China National Offshore Oil Corporation to oil and agribusiness firms like Shell, Neste Oil, Greenergy International, BioX, Cargill and Archer Daniels Midland. Peatland forest destruction, concentrated in Indonesia,

accounts for about 8 percent of annual GHG, surpassed only by the US and China (Ibid, 29).

Southeast Asia will source agro-fuels for China, which imports them already from countries such as Nigeria, Malaysia, Indonesia, and the Philippines, and has invested in Indonesian and Malaysian refineries, and Japan, which has invested in agro-fuel supplies in Brazil, and plans a jatropha biodiesel refinery in South Africa, a coconut biodiesel plant in the Philippines, and cassava ethanol refineries in Indonesia, Thailand and Vietnam (Smolker et al. 2008, 31). Meanwhile, Africa, referred to as the »Green OPEC« because of its vast land reserves, is hosting finance from Brazil, Saudi Arabia and China, the World Bank, USAID, the European Union, and private corporations to develop agro-fuels primarily for export.

Spurred by Northern energy needs and emission reduction targets a global agro-fuels complex is clearly under construction. The EU, for example, is responsible for about 18 percent of global GHG, and, as a signatory to the Kyoto Protocol, has committed to targets that depend on agro-fuels: »the EU is reducing its own emissions by raising emissions in developing countries that produce the feedstock oils (through increased deforestation and land use change, for example) and who are not bound by emissions reduction targets, especially Indonesia and countries in Latin America« (Smolker et al. 2008, 38). This process reflects an ecological crisis in the North, as declining soil fertility in the U.S. and Europe saps agricultural productivity.

Global access to cheaper resources as a solution to peak oil and soil in the North compounds the problem by capitalizing on Southern dependencies as a solution to Northern needs. Indebted states embrace carbon offset and agrofuel projects as foreign-exchange sources to repay debt. Novel oil/ energy, auto, food and biotech industrial alliances, result in new investment in Southern land, crops and agrofuel infrastructures. Agro-fuels are considered central to alternative energy supplies, but they substitute monoculture for crop rotation methods, depleting soil and producing insect and disease build-up (Padilla 2007, 7). For oil palm plantations, Syngenta claims paraquat, a widely-used herbicide banned in Europe, is »an essential tool« (Ibid, 5). Opportunities for GM crops are now considerable. As Silvia Ribeiro (ETC) reports:

All the companies which produce transgenic crops – Syngenta, Monsanto, Dupont, Dow, Bayer, BASF – have investments in crops designed specifically for the production of biofuels such as ethanol and biodiesel. They also have collaboration agreements in a similar vein with ... transnational companies which dominate the global trade in grains... And if the seeds are not for human use it will be possible to use more toxic herbicides in greater quantities (quoted in Ibid, 6).

Agro-fuel firms, in competition with food, generally seek to control their own feedstock supplies, combining refining facilities with investments in crop production: »The clear trend is towards the formation of fully integrated transnational agro-fuel networks, bringing together everything from seeds to shipping,« and financing alliances among financial companies, shippers, traders, and producers, with major investment funds, such as the Carlyle Group, »setting up their own fully integrated agribusiness/ energy networks« (GRAIN 2007, 12–13). Beyond the agribusiness complex, BP and ConocoPhillips contract with large meat processors for animal fats supplies to produce biodiesel. BP, and other companies, has developed jatropha as a feedstock,

»while Chinese and South Korean corporations are busy making deals in Nigeria and Indonesia for the large-scale production of cassava« (Idem).

The agro-fuels complex emerges through new private-public partnerships (TNI 2007). Formal or informal, these amount to a captive market for agro-fuel corporations, under pressure from governments to increase agro-fuel content of transport fuels. Agro-fuel subsidies in the US and EU equal \$ 16–18 billion a year, four times all agricultural aid to the South, which concentrates on agroexports (Seager 2008). Agro-fuels have universalized the corporate/state nexus nurtured by industrial agriculture. In the palm oil complex, for example, the Indonesian palm oil trade is managed by a combination of Cargill (world's largest private company), an ADM-Kuck-Wilmar alliance (world's largest biofuels manufacturer), and Synergy Drive, the Malaysian government firm »soon to become the world's biggest palm oil conglomerate« (Greenpeace 2007).

Recent commissions, reports, and European Parliament voting reveal second thoughts about the ecological and human consequences of offshoring and outsourcing agro-fuels in the South. On June 30, 2008, the French ecology minister said that developing a biofuels target was »probably a mistake,« and that environmental and social criteria should have been developed prior to setting a target (Phillips 2008). The same week the Gallagher Report (2008) was released in the UK, the Executive Summary stating:

We have concluded that there is a future for a sustainable biofuels industry but that feedstock production must avoid agricultural land that would otherwise be used for food production. This is because the displacement of existing agricultural production, due to biofuel demand, is accelerating land use change, and, if left unchecked, will reduce biodiversity and may even cause greenhouse gas emissions rather than savings. The introduction of biofuels should be significantly slowed until adequate controls to address displacement effects are implemented and are demonstrated to be effective.

Despite its skepticism, the Gallagher Report (2008, 9) argued that »it should be possible to establish a genuinely sustainable industry provided that robust, comprehensive and mandatory sustainability standards are developed and implemented«. However, as Biofuelwatch concluded from analysis of industry responses to standards: »The majority of biofuel industry responses, however, reject any mandatory safeguards which would ensure that the biofuels sold in Europe will have lower greenhouse gas emissions than the petrol or diesel which they will replace ... Many responses suggest that not enough is known about life-cycle greenhouse gas emissions from biofuels, but nonetheless demand government support for rapid market expansion« (quoted in Gilbertson et al. 2007, 15-16). With respect to greenhouse gas balances, current margins of uncertainty at macro- and micro- levels, render certification based on life-cycle emissions relatively meaningless (TNI 2007, 31). This refers to the difficulty in calculating and/or equating GHG emissions from land-use change, soil erosion and nitrous oxide release (Ibid, 10). According to Gilbertson et al. (2007, 39), »There are currently no peer reviewed life-cycle greenhouse gas studies for biodiesel from palm oil, jatropha or soya In addition, the Malaysian government claimed »words such as »environmentally-harmful« systems [of agro-fuel production] should be avoided as there are no internationally accepted standards« (Ibid, 15-16) – this because bio-

fuels represent an artificially-created market to respond to environmental considerations via public incentives, incommensurate with WTO protocols. The UK proposed a voluntary scheme in lieu of a standard, claiming »mandatory environmental criteria would greatly increase the risk of international legal challenge to the policy as a whole« on grounds of trade distortion (Padilla 2007, 7).

In addition to impediments in the global trade regime, there is also the structural momentum of the Kyoto protocol's Clean Development Mechanism – through which Northern entities paying for Southern projects reducing emissions are awarded carbon credits to meet their own emissions targets. Carbon market studies estimate »that the output of bioethanol and biodiesel could rise up to 120 and 24 billion litres respectively in 2020 if instruments such as the CDM support the implementation of biofuel markets in developing countries« (Gilbertson et al. 2007, 41). To this end the World Bank has inserted itself as a broker in the carbon market, in order to boost its flagging revenues. Using its institutional networks, the Bank declares local carbon capture projects (eg Durban, Minas Gerais) eligible for carbon credit exchanges with Northern governments and corporations (Wysham 2005). Thus the development paradigm, and its enforcers, are able to profit, and, in the case of the Bank, renew their legitimacy, via the new virtual frontier of carbon crediting (Lohmann, 2006).

Agro-fuels and food security

Whether or not agro-fuels account for 75 percent of food inflation, as claimed by the World Bank, crop-derived fuels directly or indirectly contribute (with corporate mediation of supply and demand) to rising prices. U.S. Renewable Fuels Standards legislation (2007) has encouraged ADM, Bunge and Cargill (who control 90 percent of the world grain trade) to diversify their monopsonistic purchases to include corn for fuel as well as corn for food« (Holt-Giménez/Kenfield 2008, 2). The diversion of US corn to fuel feedstock directly affects world grain markets, since US corn accounts for 40 percent of global production. Diversified corporate portfolios represent a deepening of power consolidation in agribusiness. Thus, in Mexico, while corn prices fell continuously following NAFTA's liberalization of corn imports from the US, tortilla prices tripled during the 1990s (Philpott 2007). During 2006, tortilla prices doubled again, so that »low-income people found themselves priced out of the tortilla market, and forced into less-nutritious alternatives like white bread and ramen noodles« (Idem). With only two food processors controlling 97 percent of the corn flour market, and the state reducing food subsidies, tortilla riots have become part of the political landscape – spurred by a 10 percent reduction in wages resulting from rural migrants displaced by corn imports (Patel 2007, 53). Structural adjustment policies underlie food riots, dismantling public capacity (specifically food reserves) and deepening food dependency across much of the global South through liberalization of trade in foodstuffs. In 2007, the Southern food import bill rose 25 percent with rising food prices (*The New York Times* editorial, April 10, 2008). Vía Campesina (2008) observes:

National food reserves have been privatised and are now run like transnational companies. They act as speculators instead of protecting farmers and consumers. Likewise, guaranteed price mechanisms are being dismantled all over the world as part of the neo-liberal policies package, exposing farmers and consumers to extreme price volatility.

Ironically, the multilateral institutions view the food crisis as an »opportunity« to incorporate small farmers into the market – as the FAO (2008) claims that: »High prices promise not only to lift farmers out of years of debt, but also to revive the livelihoods rooted in agriculture of the world's poor. The crisis of high food prices presents the world with an opportunity to invest in agriculture and secure a sustainable future for world food supplies«. The reality is that small farmers have not benefited from rising food prices, because of prior commitments of harvests at previous prices, higher input costs, and/or many small farmers self-consume (IFAD 2008, Macinnis 2008, McGregor 2008). Furthermore, a World Bank/ private foundation/ corporate investment consortium (such as the Alliance for a Green Revolution in Africa) threatens a »final land grab« for export agriculture in the guise of developing small farming, and addressing the food crisis. Food security through the global market has been an illusion, and corporate alliances profiting from flexible portfolios in food and fuel crops have emerged. However well-intentioned, renewed multilateral attention to small farmers portends further dispossession, in addition to speculative investments promoting flexible substitution between fuel and food crops, as decided by the »market.« As the food sovereignty movement claims, small farmers, and even smallholder agro-fuel producers, need their own markets, not the (corporate) »global market.«

Under pressure to promote »green accumulation,« governments and corporations are identifying »idle« land for expansion of commercial agro-fuels, but growing evidence suggests such lands »provide a vital basis for the livelihoods of poorer and vulnerable groups, including through crop farming, herding and gathering of wild products« (Cotula et al. 2008, 22-3). In India, for example, jatropha production targets »waste lands« which sustain millions of people, as »commons« and pasturelands. In addition to pastoralists, »refugees from development projects, displaced persons, jobless labourers and small farmers facing crop failure often rely on these lands as places where they can put their cattle during an emergency. If these lands are enclosed, the lifelines of many already disadvantaged people will be jeopardized« (GRAIN 2008, 8; Colchester et al. 2007). Enclosures include forests, which are habitats for indigenous people who practice low-carbon lifestyles, and whose displacement doubly endangers the planet and its cooling mechanisms. A recent UN report noted that impact studies of the oil palm plantation complex in Indonesia »conclusively demonstrates that Indigenous peoples' property and other rights are disregarded« (Ibid, 30). An ethnography of oil palm plantations in Kalimantan, Indonesia confirms the combined social and ecological effect of agro-fuel expansion:

Forest and land availability have been greatly reduced, making it more difficult for the local communities to obtain NTFP's (Non-Timber Forest Products) and leading to a lack of farming lands... As there is not enough arable land, many people have given up rice farming and a linear regression can be seen in the diversity of crops cultivated in relation to the proximity of the plantation (Orth 2007, 51).

Conclusion

The conjunction of crises expresses the socio-ecological entropy of the agroindustrial model. Perversely, this encourages »climate investment funds« and agriculture-for-development funds by the World Bank and its corporate partners, in anticipation

of further de-peasantization. This is matched by the elimination of biodiversity and vital food provisioning cultures, upon which the future of humanity depends. As the food sovereignty movement argues, and demonstrates, small farming cools the earth and feeds the world, significantly (eg Lobe 2007). Agroecology reduces the metabolic rift, restoring soils, reducing emissions up to 15 percent, and restoring grasslands. Wetlands can reduce emissions up to another 20 percent (Apfelbaum/Kimble 2007). In addition to the question of political and cultural rights, substantial research and practice supports the claim that small farms are more productive than large monocultural factories in the fields (Pretty et al. 2006; Monbiot 2008; Altieri 2008).

To address the conjuncture of food, energy and climate crises, a reversal of the modernist distaste for small-holder farming, fishing and pastoralism is necessary – rejecting peasant redundancy (McMichael 2008), and recognizing the adaptability of peasants to ecological changes under conditions of global warming.³ The irony of the development industry reproducing itself by emphasizing industrial agriculture and ignoring the rich experience of grassroots science of climate change management and sustainable food production, will not be lost on the world once the agro-fuels complex is seen for what it is: attacking climate change by attacking the climate.

References

- ActionAid (2007) We know what we need. South Asian women speak out on climate change adaptation; in Institute of Development Studies, Brighton: Sussex University.
- Altieri, Miguel (2008) Small farms as a planetary ecological asset: Five key reasons why we should support the revitalization of small farms in the Global South; in Food First, Oakland, available at: www.foodfirst.org/en/node/2115
- Apfelbaum, Steven I., Kimble, John (2007) A dirty, more natural way to fight climate change; in Ithaca Journal, (Ithaca, New York), December 6: 9.
- Chakrabortty, Aditya (2008) Exclusive: We publish the biofuels report they didn't want you to read; in The Guardian, July 10.
- Colchester, Marcus; Aik Pang, Wee; Chuo, Wong Meng; Jalang, Thomas (2007) Land is Life. Land Rights and Oil Palm Development; in Sarawak, Bogor: Sawit Watch, & Moreton-in-Marsh: Forest Peoples Programme.
- Community Media Trust; PV Satheesh; Pimbert, M. (2008) Affirming Life and Diversity: Rural images and voices on food sovereignty in South India, London: IIED Publications.
- Cotula, Lorenzo; Dyer, Nat; Vermeulen, Sonja (2008) Fuelling exclusion? The biofuels boom and poor people's access to land, International Institute for Environment and Development (IIED) and Food and Agricultural Organization (FAO).
- Fargione, J.; Hill, J.; Tilman, D.; Polasky, S.; Hawthorne, P. (2008) Land Clearing and the Biofuel Carbon Debt, in Science, February 7, Iowa City.
- Food and Agricultural Organization (FAO) (2008) FAO's initiative on soaring food prices; in Information Note, May 30; Rome, available at: www.fao.org/fileadmin/templates/worldfood/Reports_and_docs/Food_prices_web1.pdf
- Gallagher, Ed (2008) The Gallagher Review of the Indirect Effects of Biofuels Production, UK Government: Renewable Fuels Agency.
- Gilbertson, Tamra; Holland, Nina; Semino, Stella; Smith, Kevin (2007) Paving the Way for Agro-fuels. EU Policy, sustainability criteria and climate calculations, Transnational Institute, Amsterdam.
- Goodall, Chris (2008) Burning food: why oil is the real villain in the food crisis, The Guardian, May 30, London.
- GRAIN (2007) Agro-fuels special issue, Seedling/July, available at www.grain.org
- GRAIN (2008) Agro-fuels in India, private unlimited, Seedling/April, available at www.grain.org

- Greenfield, Hidayat (2007) Rising Commodity Prices & Food Production: The Impact on Food & Beverage Workers, International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations (IUF), December. Sydney.
- Greenpeace (2007) How the Palm Oil Industry is Cooking the Climate, available at www.greenpeace.org
- Holt-Giménez, Eric (2007) Biofuels: Myths of the Agro-fuels Transition; in Backgrounder, 13 (2), Food First, Oakland.
- Holt-Giménez, Eric; Kenfield, Isabella (2008) When »Renewable Isn't Sustainable.« Agro-fuels and the Inconvenient Truths Behind the 2007 U.S. Energy Independence and Security Act; in Policy Brief No 13, Institute for Food and Development Policy, Oakland.
- International Fund for Agricultural Development (IFAD) (2008) Soaring food prices and the rural poor: feedback from the field, available at: www.ifad.org/operations/food/food.htm
- Leahy, Stephen (2008) Biofuels and food prices.« Inter-Press Service News Agency, Rome, available at: www.ipsnews.net/news.asp?idnews=40929
- Lobe, Kenton (2007) A Green Revolution of Africa: Hope for Hungry Farmers? in Canadian Foodgrains Bank, Winnipeg.
- Lohmann, Larry (2006) Carbon Trading. A Critical Conversation on Climate Change, Privatisation and Power, Development Dialogue, 48, Uppsala.
- Macinnis, Laura (2008) Poorer farmers not benefiting from food price rise; in Reuters, April 29, available at www.reuters.com
- McGregor, Sarah (2008) Higher crop prices bring farmers no joy; Inter Press Service, July 7, available at <http://allafrica.com>
- McMichael, Philip (2008) Peasants make their own history, but not just as they please....; in Journal of Agrarian Change 8 (2/3): 205-228, Oxford.
- McMichael, Philip (2009) Contradictions in the Global Development Project: Geo-Politics, Global Ecology and the »Development Climate«; in Third World Quarterly, 30 (1), Surrey.
- McMichael, A. J.; Powles, J. W.; Butler, C. D.; Uauy, R. (2007) Food, livestock production, energy, climate change, and health, The Lancet, September 13.
- Monbiot, George (2007) The western appetite for biofuels is causing starvation in the poor world, in The Guardian, November 6.
- Monbiot, George (2008) These objects of contempt are now our best chances of feeding the world; in The Guardian, June 10.
- Orth, Meri (2007) Subsistence Foods to Export Goods. The impact of an oil palm plantation on local food sovereignty, North Barito, Central Kalimantan, Indonesia, Sawit Watch: Van Hall Larenstein, Wageningen.
- Padilla, Arnold (2007) Biofuels: A New Wave of Imperialist Plunder of Third World Resources, Pesticide Action Network and the Pacific and People's Coalition on Food Sovereignty, Penang.
- Patel, Raj (2008) Stuffed and Starved, Markets, Power, and the Hidden Battle for the World's Food System, Portobello, London.
- Phillips, Leigh (2008) EU biofuels target »probably a mistake; in EUObserver, June 30.
- Philpott, Tom (2007) Bad Wrap; in Grist, February 22.
- Pretty, Jules et al. (2006) Resource conserving agriculture increases yields in developing countries; in Environmental Science & Technology, 40 (4): 1114-1119, Iowa City.
- Seager, Ashley (2008) Poverty: 260m driven into hunger by push for biofuel - ActionAid; in: The Guardian July 3.
- Smolker, Rachel; Tokar, Brian; Petermann, Anne (2008) The Real Cost of Agro-fuels: Impacts on food, forests, peoples and the climate, Global Forest Coalition & Global Justice Ecology Project, Hinesberg, Vermont.
- Transnational Institute (TNI) (2007) Agro-fuels. Towards a reality check in nine key areas, Amsterdam.
- Vía Campesina (2008) A Response to the Global Food Prices Crisis; available at: www.viacampesina.org/main_en/index.php?option=com_content&task=view&id=483&Itemid=1
- Vidal, John (2007) Climate change and shortages of fuel signal global food crisis, Guardian Weekly September 11: 3. London.
- Wysham, Daphne (2005) Carbon rush at the World Bank; in Grist, March 3.

Endnotes

- 1 Thanks to Ian Bailey, Mindi Schneider and Marion Dixon for research support, and Jutta Kill for inspiration.
- 2 Agro-fuels production consumes more fossil-fuels, fertilizer, pesticides and water, and degrades the soil, globally, as President Bush's mandate of 36 billion gallons of agro-fuels per year by 2022, cannot be met without importing from Southeast Asia and Latin America, according to Eric Holt-Giménez (Leahy 2008).
- 3 Surveys following the devastation of Hurricane Mitch in Central America show that »many small farmers cope and even prepare for climate change, minimizing crop failure through increased use of drought tolerant local varieties, water harvesting, mixed cropping, opportunistic weeding, agroforestry and a series of other traditional techniques« (Altieri 2008). See also ActionAid (2007), and Community Media Trust et al., (2008).