Agrofuels

Towards a reality check in nine key areas

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Foreword

This paper has been published on the occasion of the twelfth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity, Paris, 2-6 July 2007. This review of data and publications and policy analyses on many, often interconnected issues could only be achieved thanks to the contributions of many concerned citizens and experts from many countries.

This paper sets out critical concerns regarding the current push to develop agrofuels in transport, especially in industrialised countries. We call 'biofuels' here 'agrofuels', in line with the opinion of the Via Campesina, for example, who declared that:

"We can't call this a 'bio-fuels program'. We certainly can't call it a 'bio-diesel program'. Such phrases use the prefix 'bio' to subtly imply that the energy in question comes from 'life' in general. This is illegitimate and manipulative. We need to find a term in every language that describes the situation more accurately, a term like agro-fuel. This term refers specifically to energy created from plant products grown through agriculture."

This paper does not pretend to cover all the possible impacts of large-scale agrofuel production, but to highlight some key areas in which impacts are to be expected.

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Executive Summary

This document focuses on particular types of 'biofuel' which we prefer to call agrofuel because of the intensive, industrial way it is produced, generally as monocultures, often covering thousands of hectares, most often in the global South.

Climate change: A primary concern is the potential for agrofuels to accelerate climate change, rather than combat it. Production involves considerable emission of greenhouse gases from soils, carbon sink destruction and fossil fuel inputs and is already causing significant deforestation and destruction of biodiversity. The clearance of Indonesia's peat forests to plant oil palm plantations has caused massive outputs of CO2. Once forest removal reaches a certain 'tipping point', a process of self destruction may begin, particularly in the Amazon. Because so much remains unknown, a precautionary approach to developing agrofuels is necessary.

The GM industry, having encountered widespread resistance to GM crops for food, has plans to gain acceptance for them as agrofuel crops. These crops would need to be planted as large-scale monocultures in order to be competitive. Yet, monocultures of GM crops (mainly soya and maize) as animal feed have had negative impacts, e.g.: in Argentina and Paraguay. Since animal feed and agrofuels can often be produced from the same biomass this could stimulate further expansion of GM crops. In addition, the GM industry is looking at ways to engineer crops so they can be made to break down more easily into fuel.

Second generation agrofuels: Industry promises future technologies that will yield cheap abundant agrofuels from all plant material and plant waste. GM technologies are being promoted to streamline processes and reduce costs. Research is being carried out into GM microbes that could improve breakdown and fermentation processes and methods to streamline cellulose and reduce lignin or even change its nature. Synthetic biology is a new approach that involves using genetic information to build completely new organisms with unknown impacts.

Agrofuels and biodiversity: Precious little biodiversity remains in Europe and many species are endangered. Extensive, low input farming is the most favourable system for wildlife. However, agrofuel production increases the pressure to convert such regions into intensive production of agrofuels, with crops such as oilseed rape and beet which are particularly unfavourable to wildlife. If set-aside land were brought into agrofuel production, the impacts on biodiversity would be severe, as would impacts on water reserves through increased irrigation.

In the global South, critical ecosystems are destroyed to plant crops used for agrofuels. Examples include sugarcane and soya in Argentina, Paraguay, Bolivia, and Brazil. At the same time countries such as Indonesia, Malaysia, Cameroon, Colombia and Ecuador are experiencing accelerating biodiversity loss due to oil palm plantations, often preceded by logging. In India and Africa the planting of jatropha trees for agrodiesel will threaten remaining forests.

Promoters of agrofuel expansion claim that yields must be increased by using more fertiliser and irrigation. Irrigation depletes lakes, rivers and aquifers while fertilisers cause an increased burden of nitrates in soil and water, with impacts such as eutrophication – a major threat to fish stocks. Herbicide tolerant GE crops facilitate the use of aerial spraying of herbicides with serious effects on biodiversity and small-scale farming. Indirect impacts of biofuels are already becoming apparent as US farmers switch from soya cultivation to corn for ethanol. This provides an incentive for extending soya cultivation in Latin America, where the soya boom had been faltering. As with other intensive crops, biofuel production displaces other activities to new areas, whether small-scale agriculture or large-scale cattle ranching.

Certification of agrofuels is likely to have a similar impact, displacing uncertified production to more marginal areas where it may do more damage. Agrofuels could bring about increased pressure for the release of GE trees. The impacts on forest biodiversity are extremely difficult to predict precisely because of the complexity and longevity of trees. Ironically, this may mean pressure to experiment with GE trees *in situ* with all the risks of contamination that implies.

Agrofuels and food security: Agriculture already faces huge challenges. Food production could experience serious competition from energy crops. World food reserves are falling while the demand for grains and oilseeds has outstripped supply for the last seven years. Prices have risen sharply. In the case of maize, this is due to increasing amounts of US corn being used for ethanol rather than food. As ever, it is the poor and marginalized who suffer the worst impacts. The EU and the US are setting targets for agrofuel use in transport, but will not be able to produce the feedstock themselves. Producing soya for animal feed is already causing serious problems in Latin America, while oil palm plantations have proved extremely destructive in both Latin America and Asia. Now these countries are gearing up to respond to the demand for agrofuels, further increasing the pressure on food production.

'Manufacturers of inputs such as agrotoxic chemicals (i.e. fertilizers and pesticides) expect an increased demand as a result of the attempt to increase yields. Small farmers will find it hard to compete with big producers. Some will turn from food to energy crop production and others will leave their land. This will result in a loss of local knowledge and local varieties, which in turn will diminish agricultural biodiversity.'

Agrofuels and jobs: A number of sources are asserting that agrofuels can regenerate rural economies and provide jobs. However, this depends on who controls development. To benefit local communities, agrofuel production would need to be part of a diverse farming system. But development is focused on large centralized monocultures for economies of scale and a consistent product. The impact of monocultures such as sugar cane in Brazil, is a clear example of the lack of benefit for the poor and marginalized. This is reinforced by experiences from other countries, including Paraguay and Argentina, Ecuador and Indonesia and South Africa, where communities have reacted to government agrofuel strategies. In Europe, the EC has claimed that agrofuels can provide opportunities for farmers as well as creating jobs and rural regeneration. However EU sources are highly contradictory, especially regarding the number of jobs that will actually be created, not simply replaced or displaced.'

Human rights violations have already resulted from soya, sugarcane and palm monocultures in Latin America and Asia, and these are likely to intensify through the production of agrofuels. Impacts on health arise from deforestation and pesticide spraying. Another major issue involves historical and intense land conflicts, due to monoculture expansion. Production of agrofuel crops may involve violent evictions and murders. Examples are given here from Colombia and Paraguay.

Rapid changes in land use, ecology and demography are leading to increased incidences of infectious diseases. Deforestation is increasingly recognised as playing a major role in bringing people and diseases into close contact. The impact of pesticides on health is illustrated by two examples: Paraquat in Asia and glyphosate in Latin America, both of which cause serious health impacts.

Certification: Concern about the possible negative impact of agrofuels has led to demands for sustainability certification. There are a number of different initiatives, some of which have already joined forces. The EU itself, the Netherlands, Germany and the UK are all developing initiatives. Industry is also developing standards. Some advocate mandatory certification, others voluntary. There are many issues to be addressed in devising credible systems. One of the major problems is that certification does not prevent expansion of production. Another issue relates to monitoring and compliance. None of those currently being developed have included Southern stakeholder groups affected by monoculture expansion for agrofuels from the outset. The WTO is often cited as a legal barrier to certification systems.

Resistance to monocultures, including agrofuel production, is spreading. Groups in Africa, Asia and Latin America are mobilising and demanding to be heard. Examples range from land occupations, through court cases, to national and regional campaigns. Coalitions are building against particular crops. A number of networks have produced statements of their positions directed at the EU and the UN. They insist that small farmers, local communities, the poor and the marginalised will continue to be the ones to suffer.

Chapter 1

Do agrofuels really mitigate climate change?

Agrofuels and Climate Change

A recent report from the International Energy Agency predicts that transport fuel consumption will increase faster than the amount of fossil fuels which can be replaced by agrofuels. Another concern is that the production of agrofuels requires large inputs of fossil fuels - in fertiliser production, refineries and agricultural machinery and for transport, something which is rarely considered in calculating emissions savings. There is strong evidence that any emission savings from reduced fossil fuel combustion are undone by far greater emissions from deforestation, peat drainage and burning, other land use change, soil carbon losses and nitrous oxide emissions. According to the Stern Review, agriculture and deforestation contribute 14% and 18% respectively of the greenhouse gases associated with global warming.[1] However this includes neither emissions resulting from soil degradation nor emissions from peat oxidation or fires.

There is strong evidence that the results of deforestation and ecosystem degradation can be non-linear, i.e. that both agricultural intensification and expansion could trigger large-scale, irreversible ecosystem changes and possible collapse, causing irreversible climate feedbacks. Both the Millennium Ecosystem Report and the IPCC Assessment Report Four confirm the growing risk of non-linear changes in ecosystems and climate systems respectively.

Nitrous oxide emissions from agriculture

Nitrous oxide (N2O) is the third most important human-induced greenhouse gas. Its global warming potential is 296 times that of CO2 and it has a long atmospheric life-time of around 120 years. Atmospheric concentrations of N2O have increased by 17% since the industrial revolution, mostly as a result of intensive monoculture production. Chemical fertilizer application in the tropics has 10 -100 times the impact on global warming compared to temperate soil applications.[2] Conversion of forests to cropland, use of nitrate fertilisers, large-scale planting of legumes (such as soyabean) and decomposition of organic residues have been identified as major causes of N2O emissions from agriculture.[3]

Biodiversity and secondary climate impacts from increased use of nitrate fertilizers

Humans have doubled the amount of biologically available nitrogen worldwide, and there is growing evidence that this is having disastrous impacts on biodiversity in terrestrial as well as freshwater and marine ecosystems. While the impact of nitrate fertilisers on N2O emissions from cropland has been studied, little is known about similar soil emissions over larger areas fertilized not directly but indirectly, through rainfall. Because scientists do not know the full impact of nitrogen overloading on ecosystems, it is impossible to predict how this will impact on ecosystems' ability to absorb and sequester carbon from the atmosphere. One recent study, published in the Proceedings of the National Academy of Sciences, suggests that higher levels of nitrogenous compounds in rain is causing peat bogs to emit more carbon dioxide, thus adding to global warming.[4] The author warns: "Now there are signs that indicate that nitrogenous compounds in the air make peat bogs start to give off more carbon dioxide than they bind, and that they may tip over from being a carbon trap to being a carbon source, thereby aggravating the greenhouse effect instead."

Soil carbon emissions from agriculture

No global estimate for soil carbon emissions exists, however, one study estimates that, when land in temperate zones is converted from natural vegetation to crop land, emissions from the loss of soil organic carbon are around 3 tonnes per hectare, but much higher with peaty soils. 'No-tillage' agriculture has been suggested as a way of reducing soil carbon emissions. However a recent study of 'no-tillage' soya, corn and maize production in the Argentina's Pampa shows that the additional nitrous oxide emissions linked to this cultivation method could outweigh any benefits and lead to overall increased greenhouse gas emissions.[5] Finally, using land for agrofuel production should be compared with the alternative option - allowing natural vegetation to regenerate. Renton Righelato suggests that taking plantation land in Brazil out of production and allowing natural forest regeneration to occur, would sequester 20 tonnes of carbon dioxide per hectare over the next 50-100 years.[6]

Carbon emissions from peat degradation

Around 550 billion tonnes of carbon - 30% of all terrestrial carbon – are stored in global peatlands.[7] Peat cutting and 'conversion' is a worldwide problem, partly due to agricultural expansion. Peat destruction is most rapid and extensive in South-east Asia, with Indonesia alone holding 60% of all tropical peatlands. Scientists predict that nearly all of the peat will be drained in coming decades, mostly for plantations, which will add around 40 billion tonnes of carbon to the atmosphere.[8] Palm oil expansion for agrodiesel will undoubtedly accelerate this process.

Agrofuels, deforestation and global warming
FAO figures confirm that agricultural expansion is happening at the expense of natural habitats. A recent scientific conference concluded that there is a 10-40% risk that "with partial deforestation the entire landscape could become drier and a domino effect could occur producing a 'tipping point' affecting the whole forest."[10] This is a very high risk for a high-impact disaster, which could release up to 120 billion tonnes of carbon dioxide into the atmosphere, cause the extinction of large numbers of species, and alter rainfall patterns across much of the northern hemisphere, thus putting global food supplies at risk.

As Dr. Philip Fearnside of Brazil's National Institute of Amazonian Research has said: "With every tree that falls we increase the probability that the tipping point will arrive."[11] Soya has been identified as the main cause for the high deforestation rate in South America's tropical and subtropical seasonally dry forests.[12] The expansion of soya, palm oil and sugar cane, however, is also linked to deforestation in many parts of Asia, Latin America and Africa, with disastrous consequences in terms of carbon emissions, loss of carbon sinks, and regional drying and warming trends.

Life-cycle greenhouse gas assessments
Much of the 'evidence' presented for agrofuels to reduce greenhouse gas emissions ignores the larger picture of 'land use change' (usually deforestation), soil erosion and nitrous oxide emissions. For example an evaluation of six different life-cycle assessments by Alexander Farrell et al, published in *Science* in January 2006[13] concludes that corn ethanol brings small greenhouse gas savings of 13% compared to petrol, but only if soil erosion and land conversion are ignored as with secondary climate impacts from nitrous oxide and feedback mechanisms resulting from deforestation. All life-cycle studies are micro-studies, which take no account of indirect or macro-impacts. Several studies, for example, suggest that rapeseed biodiesel produced in Europe, has a positive greenhouse gas balance. However, none of the studies factor in the extent to which the increased use of European rapeseed oil for biodiesel increases palm oil prices, thereby triggering palm oil expansion – the driving force of rainforest and peatland destruction in Southeast Asia and thus associated with far higher emissions.[14]

Need for a precautionary approach and risk assessment
It is essential that a full risk analysis is carried out, before one can even discuss measures to 'reduce negative impacts'. Further deforestation can result in abrupt feedbacks which would be impossible to stop and which could, in the worst case, push global warming beyond human control and devastate agriculture and the lives of hundreds of millions of people. The impacts are not simply 'negative impacts' which could be mitigated – like localised pollution for example. None of the certification or reporting mechanisms proposed by governments or stakeholder forums deal with the macro impacts of agrofuel production, as mentioned above: The impacts of deforestation will be the same whether agrofuels are grown directly at the expense of primary forests, or whether they displace other types of agriculture into those forests. There is an established link between commodity prices and deforestation rates, and there are no credible proposals as to how this link can be broken.

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Chapter 2

Are agrofuels a promotional instrument for GM crops and what biosafety risks do they pose?

New opportunities for old GM crops
The genetic engineering/biotechnology industry is interested in agrofuels that could allow access to new markets with the potential for rapid and sustained growth. The industry is researching whether GM varieties of crops such as maize, soya and oilseed rape all of which have encountered strong resistance to their use as food and (to a lesser extent) as animal feed, could find greater acceptance as feedstock for agrofuels. The industry has been active in contributing to so-called 'second generation' agrofuels and the use of synthetic biology (see below).

Research and development for GM crops is extremely expensive and has faced consumer rejection and opposition. Questions over whether the genetic engineering industry can develop promised traits such as drought and salt tolerance in crops have yet to be answered. Agrofuels could also be a means to achieve further public subsidies for this controversial industry.

Impacts on agriculture and biodiversity
Agrofuel crops will be grown and traded as commodities in a highly competitive global market, for example, in large scale monoculture systems as are most GM crops at present. Many of these GM crops are grown for animal feed in Argentina and other Latin American countries, and mainly exported to Europe and China.[1] The experience of these agricultural systems is also valid for the large-scale monoculture production of GM crops for agrofuels. Cultivation could build on the current feed crop cultivation, and thereby add to existing problems. Herbicide tolerant crops like Roundup Ready soya, which facilitate large-scale production with fewer workers, have been key in the expansion of soya monocultures. The use of herbicides and direct drilling means that the soil does not need turning for weed control, as in most conventional production systems. Such 'no tillage' systems have been promoted as carbon sinks under the Kyoto Protocol. The economic success of these crops depends on large-scale spraying of agrochemicals from ground-based trucks and the air.

This has led to serious impacts on local populations who lose crops and livestock and who develop skin, respiratory, digestive ailments and cancers from contamination. Mass spraying of the herbicide Roundup leads to the emergence of herbicide tolerant weeds that require the use of other agrotoxins. The use of these chemicals affects local flora and fauna, causing negative impacts on biodiversity. The corporations that control the crops and inputs for animal feed will also benefit from agrofuel expansion. All GM crops are patented. These factors promote greater corporate concentration and control of agriculture.

Links between animal feed and agrofuels
GM maize/corn, soya and rapeseed are produced for animal feed and can yield agrofuels from the same biomass. For example, maize is being processed in the US to produce ethanol with the residue being used as animal feed. The corporations involved in GM biotechnology are working to further modify maize especially for this purpose. Renessen, a collaboration between Cargill and Monsanto, is building installations to treat the residue of maize after ethanol production and turn it into animal feed.[2] In 2008 Monsanto plans to commercialise a genetically engineered maize variety, Mavera, with a high starch content for ethanol production, and high lysine for animal feed.[3] Grain trading companies and fossil oil companies are also working together to exploit this new opportunity. For example, the agribusiness firm Bunge is working with the oil company Repsol and Acciona in Spain. This joint venture has plans to build factories to refine soya oil imported from Argentina to mix with fossil fuel.

Other corporations are working on crops that will contain enzymes to assist in the process of decomposition, with the aim of simplifying the production of ethanol. Syngenta has applied in Europe and South Africa to import Event 3272, a maize which expresses a thermostable alpha-amylase enzyme (AMY797E) which breaks starch into simpler molecules of carbohydrate to assist rapid breakdown.[4] It also contains a marker gene derived from E coli.

The applications in the EU and South Africa signal that this maize is expected to contaminate both feed and food. It has been notified in the USA and China, but towards the end of March 2007, the application was refused in South Africa. Promoting an additional market for these GM crops for energy purposes will create a synergy between the two markets (animal feed and energy), so that animal feed will increasingly become a by-product of agrofuel production, thus promoting monocultures and factory farming at the expense of sustainable and biodiverse production systems and biodiversity itself. This marriage of factory farming and fuel production will make it still more difficult for countries to extricate themselves from industrial farming.

Targeted Growth is a company that focuses on increasing the yield of plants used for agrofuels. It is currently working with canola, maize and soya and began conducting field trials in 2006. It has recently (February 2007) acquired patent number WO2007016319[5] and notes in the description: *"There is a need in the art for improved methods of modifying characteristics of certain commercially valuable [sic] crops, including for example, but not limitation, increasing crop yields, increasing seed size, increasing the rate of germination, increasing root mass, and the like. The present invention as described herein meets these and other needs."* In order to achieve these different aims, Targeted Growth focused on intervening in the processes that, "regulate the transitions between different phases of the cell cycle.'' They speak of postponing the cessation of cell division, for instance, so as to increase the size of plant seeds. Investors include a number of companies interested in non-fossil energy.[6] Targeted Growth is also collaborating with the Centro de Tecnologia Canavieira in Brazil which works on producing new varieties of sugar cane.[7] *"However, these transgenic crops do come with a yield penalty. To date, no known transgenic crop is commercially available that has an increase in seed size or an increase in crop yield."* In September 2005 Targeted Growth announced a licensing agreement with Monsanto regarding use of its technology for what it calls the Yield Enhancement Gene.[8]

Conclusions

Considerable resources are being invested in GM research into all aspects of agrofuel production. GM is being used to promote existing crops for animal feed and agrofuels, which are already competing with food production. Events are moving extremely fast. The threat of climate change is being used to encourage acceptance of new techniques such as synthetic biology and wider applications of genetic engineering biotechnology. Biotech crops have already led to contamination with GMOs at every point throughout the chain from field to plate.[9] At the same time, the GM industry is promising a way out of this problem by using GM technology to solve the problems raised by second-generation agrofuels and provide fuel sources that will not compete with food production. Contamination will inevitably increase and become more complex if these same food crops are engineered with traits designed for non-food purposes. Corporate consolidation will also increase, between agribusiness, GM biotechnology and the oil industry.

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Chapter 3

Second Generation Agrofuels: How do unproven promises of future technological fixes shape the present debate?

This section concentrates in particular on cellulosic ethanol and Fischer-Tropsch gasification, which are intended to use lignocellulosic biomass. Those technologies are not yet commercially available. Some companies refer to certain agrofuel technologies that use existing feedstock such as palm oil or rapeseed oil as 'second generation' (for example Neste Oil's NExBTL diesel, which uses high-pressure hydrogenation of fatty acids), however this paper is written with reference only to the aforementioned biomass-to-liquid technologies.

Second generation agrofuels and climate change mitigation

Any technology that can help to mitigate climate change must be shown to have the potential for large-scale emissions reductions, once life-cycle emissions of all greenhouse gases have been considered. Emission reductions must happen not just at the micro-level, but also at the global level. If a technology, directly or indirectly, destroys ecosystems that play an essential role in the earth's carbon cycle, or if it indirectly delays the transition away from fossil fuel-intensive production systems, then it risks accelerating, not abating global warming.

As discussed in Chapter 1, there are many concerns that biomass-to-liquid agrofuels could have very serious negative impacts on ecosystems – including soils and forests. There is thus a risk that second-generation agrofuels could accelerate global warming by further decreasing the Earth's capacity to regulate carbon dioxide. Government research funding and policy support is increasingly being channeled into agrofuel research, and in particular into second-generation agrofuel research, at the expense of sustainable renewable energy development. The US Department of Energy, for example, is seeking to divert the entire budget for geothermal energy and advanced hydropower research to second-generation agrofuel research.[1] Meanwhile, the European Union gives stronger policy support to agrofuels than to any other type of non-fossil fuel energy. The EU has agreed to mandatory 'biofuel targets' by 2020, with specific reference to second-generation agrofuels being necessary to meet those targets.

Solid biomass-to-liquid agrofuels will almost certainly not be commercially viable in the near future, and may never become viable. There is no evidence that this technology will have the potential for reducing greenhouse gas emissions at the global level, yet they are being promoted at the expense of truly renewable technologies which could help to reduce emissions considerably. There are clear constraints regarding the amount of biomass which can be used for energy production without causing ecosystem degradation.

However any biomass which can be sustainably used will always yield greater emission and energy savings if used in heat and electricity production rather than for transport, particularly in combined heat and power generation. Regardless of any possible future technological breakthroughs, refining plant material into liquid transport fuel will always require additional energy and thus reduce any possible emission savings. In terms of climate change mitigation, the case for investing in second-generation agrofuel research has not been made convincingly.

Commercial availability of second generation agrofuels

Cellulosic ethanol:

Iogen Corporation in Ottawa, Canada, runs the only commercial cellulosic ethanol refinery. In terms of energy use and output, current cellulosic ethanol performs considerably worse than first-generation corn ethanol.[2] The different processes needed to refine cellulosic ethanol, including pre-treatment and distillation, are extremely energy-intensive. The United States Department of Energy is currently funding research into cellulosic ethanol, and has identified significant 'biological barriers' which need to be overcome if cellulosic ethanol is to become a viable option.[2] Cellulose is a difficult substance to deal with, described by the US DoE as, "heterogeneous and recalcitrant.'' Enzymes can break down cellulose, but they cannot do so efficiently, they can only produce a very dilute mixture which is then distilled into ethanol.

Making cellulosic ethanol viable is not simply a matter of scaling up existing technology and gradually improving efficiency gains. Scientists will have to understand plant physiology better, as well as the mechanisms that prevent cellulose from being broken down by fungi and microbes. Finding such organisms will probably prove to be difficult, so scientists are likely to genetically engineer microbes or fungi for this task, with all the associated risks of GM microorganisms. Work is also being done to genetically engineer plants with lower lignin levels, because the lignin in plant cell walls impedes the breaking down of the cellulose.

There are other problems to be overcome, such as converting the sugars in hemicellulose into ethanol, or making it possible to recover and use the lignin.

It is impossible to predict when, or if at all, these scientific breakthroughs will happen. Billions of dollars are being spent on a technology which clearly will not be available within the crucial time left to avoid the worst impacts of global warming. The current situation is highly reminiscent of biotech industry promises for the second generation of GM crops such as drought and salt resistant crops, which still remain elusive even after many years of research. These biotech 'futures' have been very important to maintain interest in genetic engineering. It is likely that second generation agrofuels will suffer from similar delays but will in the meantime, be used to promote the biotech agenda, with possible future 'spin offs' unrelated to ethanol production.

Fischer-Tropsch gasification: Fischer-Tropsch gasification is currently about twice as efficient at making agrofuels from solid biomass as cellulosic ethanol processes. It is used mainly to make diesel from coal, for example in South Africa. It is a highly energy-intensive process that is not currently commercially viable without state subsidies, although following heavy state subsidies after the initial capital investment, Sasol are now able to continue production without ongoing subsidies. There are concerns that any breakthrough in this technology could lead to a greater use of coal – even if the research had been financed with a view to using biomass. It appears that the technology is the same and there is nothing to prevent companies from switching from biomass to coal, or co-firing a small amount of biomass with a large amount of coal. Furthermore, large-scale take-up of Fischer-Tropsch gasification could raise fossil fuel emissions beyond the 'business as usual' scenario given by the IPCC.[3]

Second generation agrofuels and genetic engineering

The genetic engineering industry is actively seeking ways of using genetic engineering to simplify and streamline industrial processes to break down cellulose, hemicellulose and lignin, so as to produce agrofuels more easily, cheaply and efficiently from plant biomass.

The industry is looking at ways of modifying plants to:

- produce less lignin
- make it easier to break down the lignin and cellulose
- speed up the growth and yield of plants

The industry is simultaneously experimenting with engineering microbes and enzymes to break down plant matter efficiently in an extreme industrial environment as well as looking for new microbes and enzymes that could perform these tasks more effectively than those that are already known. Craig Venter, for example, has collected micro-organisms from sea water for further investigation, including so-called extremophiles living in volcanic vents on the sea bed that could withstand extreme industrial conditions. Others are looking at the microbes in termite guts because they digest plant matter very efficiently.

Companies such as Genencor and Novozymes are trying to reduce the costs of industrial enzyme production, and Diversa Corporation is studying enzymes to break down hemicellulose.[4] There is a great deal of interest in using biomass from trees for second generation agrofuels. Trees are an obvious choice if and when methods are developed to break down the plant matter cheaply and effectively. Trees require lower maintenance and fewer inputs than field crops, promising a double advantage for the industry. They also contain more carbohydrates, the raw material for agrofuels, than field crops. As with field crops, genetic engineering is being used to try to reduce the level of lignin in trees and change the structure of the hemicellulose.

The general aim is to reduce the cost of ethanol production and increase the volume produced so that agrofuels can compete economically with fossil fuels without subsidies. Willow, poplar and eucalyptus are major targets for research. Purdue University, for example, funded by the US Department of Energy is working on a poplar hybrid with the aim of producing a low-lignin, faster growing tree for mass production on 'unused' and fallow land.[5] Little is known about the impacts of releasing genetically engineered trees. What is certain, however, is that the complex interaction of trees with ecosystems, their long life cycle and their wide dissemination of fruit and pollen, all mean that whatever the impacts are, they will be of a much greater magnitude than those of annual field crops.The risks for natural forest ecosystems could be especially serious.[6]

Synthetic biology for second generation agrofuels

'Synthetic biology' is the name given to a new area of work that combines genetic engineering with nanotechnology, informatics and engineering. As ever more genomes of different organisms are mapped, providing the raw material, researchers aim not only to re-design existing organisms, but to build completely new organisms that could be more precisely designed, for example, to break down plant matter, or thrive in conditions of mass industrial processing. Craig Venter's new company, Synthetic Genomics, aims to study the genetic information from microbes collected from seawater (see above) to construct a completely new micro-organism designed to convert agricultural waste to ethanol. On 31st May 2007 the US Patent & Trademark Office (US PTO) published US Patent application number 20070122826,entitled ‘Minimal bacterial genome,’ the first application for an entirely synthetic life form. The US Government puts massive resources into a programme called Genomes to Life (GTL) that supports synthetic biology research as part of the US aim to develop alternatives to its dependence on fossil fuels.[7]

BP (formerly, British Petroleum) has offered 500 million US dollars to the University of California at Berkeley for research into agrofuels. A major component of this work will be genetic engineering research into lignocellulosic fuels that will include the use of synthetic biology. BP has also joined the Bio-Industry Association. This clearly demonstrates one of the most disturbing aspects of the development of agrofuels – they bring together powerful players from different sectors of the oil industry, agribusiness and biotechnology, creating a danger that corporate power will be further concentrated across the agriculture and energy sectors.

Second generation agrofuels impact on ecosystems, the carbon cycle and the global climate

Advocates of large-scale use of biomass for second generation agrofuels (such as the US Department of Agriculture (USDA), the US Department of Energy (DOE), or the International Energy Agency) assume that large amounts of wood, grasses, and ‘plant waste’ can be sustainably used for agrofuel production. If second-generation agrofuels were to become viable, their production would rely on large-scale refineries, which would need a constant supply of very large amounts of biomass. A 2005 DOE/USDA report, for example, speaks of using 1.3 billion tonnes of dry biomass every year, just from the US.

To accomplish this, the authors say it would be necessary to remove most of the agricultural residues from soils, to plant 55 million hectares of land in the US under perennial crops for agrofuels, using more manure than the Environmental Protection Agency currently allows, and to put all US cropland under ‘no-tillage’ agriculture, which would require vast increases in the use of pesticides and fertilizers.[8]

The removal of organic residues from fields will require greater use of nitrate fertilisers, thus increasing nitrous oxide emissions, nitrate overloading and its very serious impacts on the biodiversity on land, freshwater and oceans. The complete removal of plant material is also likely to accelerate topsoil losses, causing further decline in soil nutrients. This could have serious implications for human health in terms of future nutrient deficiencies in food crops. It is also likely to reduce soil water retention, making agriculture more vulnerable to droughts.

The removal of dead and dying trees from managed forests already leads to large-scale biodiversity losses and possibly to lower carbon sequestration in forests. According to a recent study, less than 5% of the biomass in managed forests in Germany is made up from dead or dying trees or fallen branches, whereas in natural forests they account for around 40%. It is estimated that 20-25% of all woodland species depend on so-called ‘forestry waste’ being left in woodlands – including 1,500 types of fungi and 1,350 types of beetles in Germany alone, as well as many other species of insects, lichens, birds, and mammals.

Removing even more ‘wood residues’ for agrofuels would almost certainly accelerate biodiversity loss and reduce carbon storage in forests. Growing millions of hectares of land under perennial crops for bioenergy will put intense pressure on land both for food production and communities, and for natural ecosystems. Many plants which have been identified as preferred choices for second generation agrofuels already cause serious environmental harm as invasive species, such as miscanthus, switch grass, or reed canary grass.[12] So called ‘set-aside’ land in the EU and areas of the Conservation Reserve Programme in the US are already being sacrificed for biomass expansion. These programmes play a major role in reducing soil erosion and depletion and halting biodiversity decline. Suggestions have been made that biodiverse prairie or meadow grasses could offer the most productive feedstock for second generation agrofuels and increase soil carbon sequestration.[10]

However, the technical hurdles of such multiple feedstock are considerably greater than for monoculture feedstock – a mix of different enzymes would be required to break down the different plant materials effectively, which would be far more complicated than breaking down one particular feedstock. Investment in research and development is very clearly biased towards genetically engineered monocultures rather than native, biodiverse grass mixes, and it seems unlikely that companies would delay commercializing second generation agrofuels in order to wait for more environmentally-friendly sources of feedstock.

It is currently argued that yields per hectare of agrofuel crops will increase in the future, but there is no evidence for such an assumption; in fact global grain yields have fallen for the past two years, and European rapeseed yields have fallen for the past three years. A recent study by the Carnegie Institute found that global grain yields have already been reduced by global warming – a trend which can only worsen. [11] Falling per-hectare yields will result in more pressure on land to produce the same amount of agrofuels.

Conclusion

Cellulosic ethanol is not close to becoming commercially available, and faces technical barriers that may not be overcome in the foreseeable future. Much of the cellulosic ethanol R&D investment goes into genetic engineering, without any risk assessment. Fischer-Tropsch biodiesel faces different serious technological hurdles, and its R&D might inadvertently aid greater consumption of coal. There has been no assessment of the consequences of using large amounts of biomass from so-called 'plant waste', from tree plantations, or from perennial crop plantations on food production, ecosystems, global greenhouse gas emissions, soil fertility, or water supplies. This means that there is no evidence that large-scale second-generation agrofuels would be either sustainable or climate-friendly. Furthermore, the promises being made by industry about future second generation biofuels are being used by governments, including the EU to promote agrofuel production. In this way, they justify the large-scale expansion of first generation agrofuel monocultures, particularly in the global South, despite growing evidence of severe negative impacts on communities and the environment.

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Chapter 4

How will large scale agrofuel production affect biodiversity?

Agrofuels and Biodiversity Losses in Europe
Within Europe, 52% of freshwater fish, 42% of mammals, 45% of butterflies and reptiles, 30% of amphibians are at risk of extinction. Birds, insects and wild flower species face similar rates of decline. Already, 60% of wetlands have been destroyed in northern and western Europe, and little natural forest remains intact.[1] Agriculture is a major driver of biodiversity losses, due to habitat destruction, use of pesticides (leading to a loss of insects), monocultures, nitrate-pollution of freshwaters, and nitrate overloading of terrestrial ecosystems.

It appears unlikely that the EU can meet its target of halting biodiversity losses by 2010, with existing regulations having failed to slow biodiversity losses, and with the likelihood that set-asides will be abolished and agriculture will be intensified over large areas. The European Commission has announced its intention to abolish compulsory 'set-aside' lands from 2008, in order to increase agrofuel expansion. According to a 2004 report by the European Environment Agency (EEA) and UNEP,[2] protection of biodiversity requires the protection of extensive farming practices with low agricultural inputs, classed as 'high nature value farmland'.

In Friesland in the Netherlands, for example, 60% of plant species are confined to the 1.5% of the region's land under such extensive farming, and there are large areas still under high nature value farming in Spain, the Netherlands, Italy, Greece and Belgium. The EEA has warned that the conversion of extensively farmed land to energy crop production of intensive food production, in order to meet the growing demand for land, will result in further losses of biodiversity.

The 2006 'Wells-to-Wheels' report by the JRC, Concawe and Eucar warns that growing energy crops rather than permanent crops, such as grasses, or at the expense of set-aside land will decrease Europe's biodiversity.[4] According to this report, biodiversity impacts are highest for oilseed rape, medium for sugar beet and low to medium for short rotation forestry that can, however, only be used for heat and power generation, not liquid agrofuels.

Increased use of pesticides is likely to result from the abolition of compulsory set-asides, and also if the frequency of sugar beet rotations and, to a lesser extent oilseed rape, is increased beyond one year in four. The largest amounts of pesticide are used for sugar beet, and the authors of the study warn that farmers might escape pesticide level controls if they grow crops for agrofuels, not food.

Another major impact on biodiversity identified in this study is the increased pressure on water resources, particularly if agrofuel crops are grown in arid areas where they require irrigation. All sugar beet cultivation in Greece, 77% in Spain and one third in Italy requires irrigation. According to this study, agricultural intensification is driven by crop prices, making intensification of oilseed production particularly likely. However, production of 1 kg of soya requires 2,300 litres of water.[5]

Despite low and falling water tables and drought conditions in parts of southern Europe, high maize prices, linked to the global rise in corn ethanol demand, have encouraged farmers in Greece and Spain to plant maize, which has high irrigation requirements and threatens to further reduce water supplies, which could have serious effects on biodiversity.[6] Drought conditions, particularly in southern Europe, are expected to worsen considerably in coming decades as a result of climate change. Bird Life International has warned that agrofuel production in Spain and Portugal threatens semi-natural steppes and long fallow-dry cereal systems, which are among Europe's most biodiverse habitats.[7]

They also state that oilseed rape expansion in Germany has been linked to the decline in clover and alfalfa which provide key habitats to endangered species such as the red kite and ortolan bunting, and that an increase in maize cultivation leads to the loss of wildlife habitat which less intensively farmed crops provide. In Finland, according to Birdlife International, oilseed rape can only be sown during spring, which has the worst impact on biodiversity and is linked to serious water pollution. Agrofuel production is therefore a very serious risk to Europe's biodiversity, which is already in steep and rapid decline. If agrofuel expansion proceeds as planned by the EU, then the target of halting biodiversity losses by 2010 will almost certainly be missed and current extinction rates may well accelerate.

Agrofuels and Biodiversity Losses in the Global South
The highest yield agrofuel feedstock are those grown in tropical regions, where photosynthesis rates are highest. Sugar cane and palm oil have the highest rates. Other monocultures which are being expanded for agrofuels in tropical and sub-tropical areas include soya, jatropha, maize, and, to a lesser extent, sorghum, canola and cassava. Agrofuel expansion is linked to both agricultural expansion and intensification, and both trends are associated with high biodiversity losses.

Destruction of old growth forests and natural grasslands for soya and sugar cane in Latin America

Soya has been identified as the main current driver for deforestation in the Amazon. According to a 2006 NASA report, the price of soya directly correlates with the rate of forest destruction in that region.[8] Agrofuel expansion is expected to push up the price of soya, not just by creating an additional market for soya biodiesel, but also by pushing up the price of corn that is displacing soya production in parts of the US.[9] Soya expansion has also been identified as the main cause for the high deforestation rates in Latin America's tropical and semi-tropical seasonally dry forests since the late 1990s, particularly in Argentina, Paraguay, Bolivia and Brazil.[10]

The same study directly links the acceleration in deforestation in Argentina's semi-arid Chaco from 1997 to the introduction of GM Roundup Resistant soya, which reduced plantation costs and made soybean expansion in this climate zone profitable for the first time. A report by the World Wildlife Fund for Nature states that sugar cane plantations for ethanol increased deforestation in Brazil's Mata Atlantica, particularly in the state of Alagoas, where only 3% of the original forest remain.[11]

Several examples from Brazil show the destruction of original vegetation in the Cerrado. For example, in the state of Sao Paulo, the regions of Franca, Araquara, Ribeirao Preto and Sao Carlos, statistics show that 85% of the original vegetation has been destroyed, largely due to the expansion of sugar cane and soya plantations. The Cerrado is the world's most biodiverse savannah. It is home to an estimated 10,000 species of plants (4,400 of which are endemic), 195 species of mammals, 607 birds, 225 reptiles, 186 amphibians and 800 fresh water species.[12] Over 90% of the original Mata Atlantica has been destroyed. The remaining forest is home to over 20,000 plant species (40% of which are endemic), 55 endemic species of birds, 21 endemic mammal species, and 14 endemic amphibian species, all threatened with global extinction.

A 2005 study by the United Nations University, published by NASA, warned that the Pantanal wetlands, found in Brazil, Bolivia and Paraguay, are under intense pressure from agriculture, including sugar cane and soya plantations.[13] The Pantanal is the world's largest tropical wetland area, with high biodiversity. The Pantanal is home to at least 650 bird species, over 190 species of mammal, 50 reptiles, more than 1,100 butterfly species and 270 fish species. It is also the wintering grounds for a large number of migratory birds that summer in North America.

In February 2007, Global Nature Fund and Ecotropia warned that licenses for new ethanol distilleries in the catchment of the Pantanal will lead to savannah areas with high biodiversity being destroyed to make way for new sugar plantations, and will cause further deforestation, soil erosion and water pollution. They also warn that the Pantanal is threatened by the conversion of the Cerrado highlands to soya and sugar cane, which leads to erosion, water pollution and a disruption of the hydrological cycle on which the Pantanal lowlands depend.[14]

Deforestation, biodiversity losses and palm oil

Indonesia lost 24.1% of its forest cover between 1990 and 2005. Since the end of the 1990s, deforestation rates have climbed by 26%. Rising deforestation rates have gone hand in hand with the expansion of oil palm plantations from 600,000 hectares in 1985 to 6.4 million hectares in 2006. The Indonesian government plans the conversion of another 20 million hectares in the next 20 years.[15]

Much of this expansion is happening at the expense of forests and peat swamps. The Borneo-Orangutan Survival Foundation have warned that palm oil expansion means the end for much of Indonesia's biodiversity, including the orang-utan, the Sumatran tiger and Indonesia's Asian elephants.[16] Malaysia is the world's largest producer of palm oil and oil palm expansion has been accompanied by the largest increase in deforestation rates anywhere in the tropics. Large oil palm concessions have been granted in forest and peatland regions, with 100% tax breaks. Throughout South-east Asia, palm oil expansion and logging for timber are inextricably linked. Sinar Mas and Raja Garuda Mas, for example, own palm oil and biodiesel companies, as well as the cellulose/logging companies APP and APRIL that are linked to the large-scale destruction of Sumatra's rainforests.

Natural forests and savannah in many other tropical countries are also being destroyed for palm oil, including Cameroon, Colombia and Ecuador. In Ecuador, only 2% of the coastal forest remains and they are now threatened by logging and oil palm expansion. This forest is classed as a 'biodiversity hotspot'. There are strong business links between logging and palm oil companies, and biofuel demand is spurring further destruction of the remaining forests.[17] In Colombia, 285,000 hectares are under oil palms, mostly along the Caribbean coast in the north, in the Pacific coastal province of Chocó – which has the greatest biodiversity in the country in the northwest, and in the central-eastern Llanos (plains) region. The government is pushing for a large-scale expansion to meet the growing demand for biodiesel, threatening the high biodiversity of the Llanos savannah as well as rainforests.[18]

Jatropha biodiesel and biodiversity in India

The Indian government is promoting the rapid expansion of jatropha monocultures for biodiesel on 50 million hectares of lands classified as 'wastelands'. Jatropha is widely promoted as a crop that can grow in dry regions, however regular and sufficient rainfall is needed to sustain high yields. In arid and semi-arid areas, fertilisers and irrigation are needed for the first three years. In large parts of India, ground water tables are falling, threatening the future of agriculture over large areas. The head of the World Institute of Sustainable Energy in Pune, G.M. Pillai, has warned that promotion of jatropha for biodiesel is likely to lead to the destruction of primary and secondary forests in India, with serious consequences for biodiversity.[19] Communities in the Himalayan foothills are extremely concerned that jatropha will threaten the forest and the biodiversity on which they depend for their livelihoods. In Chhattisgarh, for example, the state government is promoting jatropha without any feasibility study, even though alien invasive plants are a prime driver for biodiversity losses in the area. The NGO Sutra has warned: "Jatropha is a weedy species and spreads itself very fast leaving lesser grasslands for grazing animals. Some cases have been reported from Chhattisgarh where animals died after eating its leaves."[20]

Agrofuels and loss of agricultural biodiversity

Many of the agencies and institutions that promote agrofuel expansion believe that the additional demand for crops can and should be met by intensifying agriculture in order to increase yields, particularly across the tropics and sub-tropics.[21] The Food and Agriculture Organisation confirm that, in recent decades, yield rises have gone hand-in-hand with agricultural intensification, including increased irrigation and fertiliser use.[22] This suggests that, if ambitious proposals for agrofuel proposals were realized, both irrigation and fertiliser use would grow considerably.

The depletion of water supplies in aquifers, rivers and lakes is one of the major threats to biodiversity, and around 70% of human freshwater demand is for irrigation. Global fertiliser use has increased from less than 14 million tonnes in 1950 to about 145 million tonnes in 2001.[23] Nitrogen fertilization is one of the main reasons why the amount of biologically available nitrogen has more than doubled. This has serious consequences for terrestrial biodiversity, as nitrates are carried over larger areas and over-fertilise ecosystems. In freshwater and marine ecosystems it causes eutrophication and anoxic 'dead zones' which, according to UNEP, have become one of the greatest threats to global fish stocks. The production of fertiliser itself is very energy intensive.

Genetically modified crops and biodiversity loss

GM crops are readily adapted for GM soy monoculture production (Roundup Ready) in Argentina and Paraguay, which are already being used for biodiesel. However, the herbicide-tolerant crops that currently dominate and that are most likely to be used for agrofuels (soya, oilseed rape, maize) require major inputs of herbicide, which is often sprayed from the air. This has serious impacts on biodiversity. The emergence of herbicide tolerant weeds means that other herbicides have to be applied. Local communities in areas of Argentina where aerial spraying takes place frequently suffer the effects of health problems and contamination of other crops and livestock. Many are driven off their land. This implies the loss of agricultural biodiversity (locally adapted non GM crops selected and conserved by local communities) and the knowledge that the communities hold, especially if these are indigenous communities.[24]

Conclusion

Agrofuels already have major negative impacts on biodiversity. Agrofuels are mainly produced as monocultures, implying a further shift from traditional, high-biodiversity farming methods to intensive industrial farming methods which provide little or no habitat for other species. Agrofuels are also leading to a rapid expansion of the agricultural frontier, including in South-east Asia and Latin America, where millions of hectares of natural forests, grasslands and wetlands, all with high biodiversity, are being converted to agricultural use.

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Chapter 5

Does the structure of global agrofuel production threaten food security?

The prospect of competition between uses of agricultural resources for energy versus food is extremely worrying. According to FAO's latest report on world food perspectives, "*Traditional food and fibre use of land may lose out in this competition simply because, on the margin, the potential market for energy is huge in relation to that for food, eventually leading to rising food prices. The latter may not dent the welfare of those who can afford to pay higher prices for both food and fuel, including the population groups that benefit from the development of biofuels. However, low income consumers that do not participate in such gains may be adversely affected in their access to food.*"[1]

The drop in global output of major food crops due to droughts or other adverse conditions in recent years, combined with growing demand, is already a cause for concern. In 2006, world cereal reserves fell to their lowest level in more than two decades, and FAO has reported a disturbing food supply situation, with demand surpassing supply both in grains and oilseeds, and has called for closer monitoring of the world food situation.[2] In the case of wheat production, short-falls and growing demand (including for ethanol in Europe) in 2006 resulted in a large reduction of world grain reserves, with global stocks expected to fall to 28 million tonnes, or 16 percent, the lowest level since the early 1980s. Forecasts for the 2006/07 marketing year confirm a tight supply situation for coarse grains and oilseeds, where production may not be sufficient to satisfy global demand, thus necessitating a sizeable reduction in stocks. [3]

In six of the last seven years, humans worldwide consumed more grains and oilseeds than were produced.[4] It is feared that the sharp fall in global reserves may lead to a more precarious situation in the future if weather problems should prevent an increase in world production, resulting in higher international prices and threatening food security worldwide.[5] In fact, higher world prices in 2006 have already led to cuts in imports in some wheat importing countries, like Nigeria, and increasing maize demand for ethanol in the US has driven maize export price up some 70%, triggering food problems and social unrest in Mexico, where the cereal is a staple. The FAO stated recently, "*Against this background, a massive increase in production would be needed in order to prevent stocks from eroding further and to thwart price escalations.*"[6]

According to the FAO, global expenditure on food imports increased by 5% in the past 12 months, while expenditure on grain and vegetable oil imports rose nearly 13%. *"Among economic groups, developing countries as a whole are anticipated to face a 9 percent increase in aggregate food import expenditures in 2007. The more economically vulnerable countries are forecast to be most affected, with total expenditures by LIFDCs and LDCs anticipated to rise by 10 percent each from last year. To put matters in further perspective, the annual food import basket for LDCs in 2007 is expected to cost roughly 90 percent more than it did in 2000, which is in stark contrast to the 22 percent growth in developed country import bills over the same period."* FAO consider agrofuels to be the main driver for rising food prices.

Agrofuel consumption in industrial countries (currently still only a fairly small percentage of actual gasoline and diesel use) is reported as exerting growing pressure on food supplies.[7] In the US and the EU, with transport sectors that use an ever-larger volume of fuels, rising oil prices and incentives such as tax exemptions and blending obligations have encouraged increasing agrofuel production and use in recent years. The US Energy Policy Act of 2005 mandated substitution of 7.5 billion gallons of gasoline per year by agrofuels, a goal that is already having significant implications. Production of maize-based ethanol in the US is projected to reach 5.9 billion gallons in the marketing year 2006/07, and 9.7 billion gallons by 2010/11.

Though still a modest fraction of a yearly gasoline consumption of roughly 140 billion gallons, this production is very significant in terms of agriculture, demanding a growing fraction of US corn harvest: from some 6% of domestic corn production devoted to ethanol at the start of the decade, to 20% in 2006 and to an estimated 28% in 2010.[8] The new target of 35 billion gallons of alternative fuels announced recently by President Bush would require devoting almost the entire US domestic production of maize to ethanol.[9] Thus the world's largest maize exporter, the US is now turning to its southern neighbours to secure a supply of (cheap) feedstock for agrofuels. In the EU a 2003 directive on the promotion of the use of agrofuels for transport set a reference target of 2% agrofuel use in road transport for 2005 and of 5.75% for 2010. Nonetheless, in March 2007 the European Council of Ministers agreed on a new, mandatory target of 10% agrofuel use for transport by 2020.

In 2005, most EU countries were far from meeting the indicative target. Overall, 3.9 million tons of agrofuels were produced, amounting to less than 1% of total fuel demand for road transport. Nevertheless oilseed demand for biodiesel, which accounted for 81.5% of total agrofuel production in 2005, is substantially increasing European dependency on imports. [10] The EU is already the world's largest importer of food, and its massive imports of animal feedstuffs (75% of its proteins needs for feed are imported) are the main reason for the existence of its animal and cereal surpluses.[11]

In 2005 the EU imported half of its total oilseed requirements, while in 2006 the FAO reported that, "*after two years of exceptional expansion, imports are expected to continue growing strongly because domestic oilseed production is not sufficient to satisfy both, demand for food uses and for biofuel production.*"[12] Should European Common Agricultural Policy (CAP) subsidies be moved to agrofuels, giving priority to fuel security over food security, there will be strong competition in land use for food/feed/forest/fuel. It is estimated that the maximum possible overall production of conventional agrofuels (ethanol and bio-diesel combined) in the EU can only cover around 4.2% of the road fuels market, and that meeting the 5.75% biodiesel target will require an additional 14% of the world oilseed harvest foreseen for 2012.[13] Targets for agrofuels in industrial countries, in particular the US and the EU, are creating a huge market that will encourage exports from tropical regions, seriously undermining food sovereignty.

In the case of soya, for example, an FAO June 2006 report (presumably not considering recent increase in targets) estimates that the main producing countries (USA, Brazil and Argentina) would need to triple production in order to supply the agrofuel market and that "*a near doubling of the area under cultivation would be probably required, even assuming future yields matched the highest yield encountered currently in rain fed cultivation under high input technology in the USA.*"[14]

Taking into account that the USA already uses all the suitable land for soya, and that demand for ethanol and rising prices in cereals are expected to cause an increase in land devoted to grains in this country at the expense of soya, it seems that the only available 'surplus' is to come from southern producers. The expansion in soya cultivation for export in Brazil and in Argentina has already taken a tremendous toll in these countries. Not only has it spurred deforestation and destroyed valuable ecosystems, driving indigenous peoples and small farmers from their territories, it has also displaced small farmers and local production oriented towards meeting domestic food needs.

As Grupo de Reflexión Rural comments: "*The export model exemplified by soya seriously threatens food sovereignty in Argentina…In recent years, soya has replaced the production of food staples, which are now being imported.*"[15] The rapid expansion of oil palm plantations in Indonesia, Malaysia and other developing countries, encouraged by expectations of a huge agrofuel market, is also having devastating impacts not only on the environment but also on local farming economies and food sovereignty.

In addition to the expansion of agricultural land, rising agrofuel demand is to be met by an increase in crop yields, with increased inputs in order to maximize production. According to the European Fertilizer Manufacturers Association: *"Over the next ten years… nutrient use for oilseeds will increase by 35% and even by 49% for oilseed rape. This is due to an increase in biodiesel production."* [16] On the other hand, the rapid development of agrofuel markets is encouraging investment in farming operations by the agrofuel industry, already prospecting developing countries for suitable land for energy crops.

Conclusion

Small farmers in these countries will not be able to compete with large-scale, export-oriented, intensive productions managed by industry. Many are forced – sometimes through the use of violence – to abandon farming and migrate to cities, adding to the significant fraction of world population already living in precarious situations in urban peripheries, extremely vulnerable to rising food prices (see Chapter 7). The escalating demand for agrofuels will encourage small farmers to plant energy crops rather than crops cultivated to meet family needs and/or supply local markets. This will increase dependency on purchased inputs and on distant markets that communities are unable to control, and threaten local subsistence and food security. In addition to significant environmental, social and economic damage, intensification of agriculture and the displacement of small farmers is bound to entail a dramatic loss of local crop varieties and associated knowledge, further undermining local agricultural sustainability and food sovereignty.

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Chapter 6

What is the real impact of agrofuels on rural development and jobs?

There is a widely held assumption that agrofuels could assist rural development. Both FAO and the EU assert that small and medium enterprises could benefit and that jobs could be created in producer countries.[1] The EU also asserts that agrofuels could help rural regeneration in Europe, yet its own data does not support this conclusion. Whether or not such development will actually happen strongly depends on what type of agrofuel development will be promoted and who will control it. Small scale agrofuel projects under control of local communities when principally intended to meet their own needs, as part of a decentralised and diverse agricultural production system, has the potential to benefit rural areas. However, the current agrofuel development is taking shape in a highly centralised manner, to create economies of scale, and a consistent product, to meet the demands of market capitalism.

Within this scenario, it is unlikely that rural communities will be able to influence the process or participate in it to their own benefit. Agrofuel development as monoculture expansion controlled by agribusiness is causing people to be expelled from their land, often forcibly, to end up living marginal lives in urban slums. Those who stay are likely to suffer the impacts of mass aerial spraying of pesticides, loss of their harvest, animals and health. Those who are offered land as part of the development of agrofuels, e.g. oil palm production, have no control over the market and may end up heavily indebted. People are left with very few options: To accept minimal wages or to see themselves displaced by mechanisation (e.g. sugar industry).

The Brazilian Forum of NGOs and Social Movements for the Environment and Development (FBOMS) sums up the impacts of monoculture, that have multiplied in recent years:[2]

- Illegal deforestation in order to make place for new sugar cane, soya plantations, or eucalyptus forests;
- **Expulsion of small farmers from their land, sometimes through the use of violence, generating rural conflicts;**
- **Land concentration in the hands of latifundo owners, in some cases in areas donated by the government;**
- Intensive use of agrotoxics and other agrochemicals, threatening the health of farmers and the population of nearby areas, mainly when aerial spraying takes place;
- Contamination of the soil, rivers, subterranean and spring waters, due to deforestation and the high quantity of chemical products used in monoculture areas, as well as vinhace (sugar cane industry liquid waste) disposal in soil and rivers;
- **Rural and urban poverty, because besides the expulsion of small farmers from their lands, monoculture hardly creates jobs. With no option, many rural workers move to the periphery of the cities.** (emphasis added)

According to the FBOMS report, *"Rural and urban poverty, because besides the expulsion of small farmers from their lands, monoculture hardly creates jobs. With no option, many rural workers move to the periphery of the cities. The rural activities that least generate jobs are: sugar cane, corn, soy, eucalyptus and cattle raising, precisely those that happen most of the time in great properties.... Biofuels come in as one more demand that can worsen the situation. Through a monoculture regime, it is not possible to promote the sustainable development of Brazil."* For each 100 hectares, there is one job in eucalyptus plantations, two for soya, and ten for sugar cane.

A large number of Paraguayan organisations and movements signed a declaration[3], responding to the second conference of the Round Table on Responsible Soy, saying that *"…the expansion of monocultural "green deserts", such as large scale soy production, non-native grasses and exotic trees, promotes and increases a mechanized agriculture without small farmers; without people. All monocultures are damaging to the ecosystems they supplant; they cause poverty, unemployment and the eviction and exodus of communities in rural areas. They destroy biological and agricultural diversity, poison water sources and the soil and undermine the food security and sovereignty of the people and their countries."*

Twenty-nine South African organisations responded to their government's Draft Biofuels Industrial Strategy by saying *"As affected rural communities and organisations, we are astounded that we have not been properly informed and consulted about the strategy. What makes it all the more unforgivable is that the anticipation of a subsidised Biofuels industry is precipitating massive "land grabs" of municipal commonages and traditional communal and tribal land in the former independent homelands. While the DME pays lip service to developing Biofuels to meet local energy needs, deals have already been struck for large-scale plants to export Biofuels to the European Union. In the process rural farming communities are coerced into signing over their land for a pittance for industrial plantations of canola, maize and soya*." [4]

Realities of sugar cane workers in Brazil

According to FBOMS, sugar cane cutters are paid for their daily work only if they meet a pre-established production quota. Many are hired by intermediaries and come from other regions. *"They live on the farms, in cabins with no mattresses, water or stove, cook in cans over small campfires and buy their food in the farm paying sums that are well-over market prices."* If wages were increased even by a small margin, this would give plantation owners an incentive to mechanize and reduce their workforce, resulting in many workers losing jobs. Working conditions include poor housing, lack of water and sanitary provisions, lack of sufficient food, no work training, use of agrochemicals without sufficient protection, health impacts of sugar cane burning before harvesting, minimum rest and exhaustion, wage level under living standards, child and even forced labour. [5]

Realities of oil palm smallholders in Indonesia and Ecuador

"It's as if we were ghosts on our own land. We have been so pierced through by the spines of the oil palm that we are almost dead, left haunting what was once our own land. We don't usually say this, but this is how it is really. We need to make our case ourselves and explain how the oil palm is hurting us."[6] (Workshop participant RSPO Smallholder Taskforce, Bodok, Sanggau, West Kalimantan, 7 June 2006)

The recent report from SawitWatch on oil palm smallholders in Indonesia gives a bleak picture of the true nature of rural development brought about by oil palm expansion. Large-scale government schemes were established to pressure rural and indigenous communities to give up their lands to make way for large oil palm plantations, in exchange for titles of 2-3 hectare lots already planted with oil palm around the plantation. Out of every 10 hectares given up by local people for conversion to oil palm, approximately 4 were allocated to them as smallholdings, *"…unless lands are also allocated to incoming migrants, in which case their share may be even less."* The smallholders were immediately indebted for the preparation and planting of the lots. Most small farmers are dependent on the large estate for the crushing and sale of the end product, without having proper information about prices. Prices are set by provincial government commissions that include representatives of major oil palm estates and mills, but no smallholder representation. The money that should be received based on this price is then reduced by all kinds of fees, sometimes even for the time spent waiting in the queue. Most smallholders interviewed by SawitWatch argue that their two hectare holding, with house plot and subsistence garden, *"…does not provide a sustainable livelihood given the prices they get for their crops and the overheads they have to pay."*

Another example comes from the expansion of oil palm plantations in Ecuador. According to Rettet den Regenwald (Germany), hundreds of families have been displaced to poor neighbourhoods in the main cities as a consequence of selling and loosing their land. Members of affected Afro-Ecuadorian communities have also been affected by oil palm expansion testifying that, *"…there are very few people left in the communities, especially those who lost their land and who now work on the oil palm plantations. Those who sold their land feel ashamed and the palmeros want them to leave the communities, so that they won't make protests in the future…. Lack of communal lands turns us into urban men and women, without possibilities to build a life project on our collective lands. From now on, one of our objectives is to reclaim our communal land."* [7]

Realities of smallholders and rural workers in Paraguay and Argentina

Soya cultivation is most profitable when undertaken in a capital intensive and labour extensive fashion. Roundup Ready soya cultivation has displaced more labour intensive cultivations like vegetables, cotton as well as dairy farming. While soya plantations expanded, between 1996 and 2002, the rural population in Paraguay decreased by 6.3%. Almost half of the Paraguayan population lives below the poverty line, and 21% in extreme poverty. Land concentration is extreme; 1% of landowners own 77% of the land. 40% of all producers cultivate land between 0.5-5 hectares in size.[8] Paraguay has signed a declaration of intent with the EU about producing agrofuels. Soya production has increased up to 2,426,000 hectares.

The Paraguayan authorities plan to increase this to 4 million hectares. According to Base Investigaciones Sociales, (BASEIS), *"..this projected expansion of monocultures will mean an increased number of smallholders expelled from the countryside in Paraguay."* According to Sobrevivencia (Friends of the Earth, Paraguay), approximately 70.000 people leave rural areas each year. Many of them end up working on the rubbish heaps around Asunción. Although there is less reliable data, the same is largely true for indigenous people that inhabited the forests, like the Mbya Guaraní, who mostly end up living on the streets of Asuncion. Most of the land for soya expansion in Paraguay has been purchased from smallholders, causing the disappearance of rural communities. Rising land prices creates an incentive to sell.

The advancement of the soya frontier is closely related to rising land prices. Another reason for smallholders to feel forced to abandon their land is the agrochemical use, namely on Roundup Ready soya plantations, which causes loss of their harvest, death of animals, and severe health problems due to polluted air and water. In both Argentina and Paraguay, lack of employment opportunities in the cities causes people to end up living in the 'villas miserias' (slums), trying to make a living in the informal sector. In addition, many migrate to neighbouring countries. Around one third of the Paraguayan population now lives abroad.

Rural development and jobs for Europe

Agriculture in Europe continues to be in a permanent state of crisis. The EU Agriculture Commissioner, Mariann Fischer Boel, has stated that agrofuels provide opportunities for farmers and for regeneration in rural parts of Europe.[9] However, the EU's own documents contain contradictory conclusions. Attempts to calculate the number of jobs that could be generated by agrofuels vary widely. All commentators appear to agree that combined heat and power is a more efficient use of biomass than agrofuels production, but they also consider that agrofuels will create or sustain more direct and indirect employment, mostly in production and processing of agricultural and forestry feedstock.

However, they also admit that "different studies give widely different figures," which seem to range between two and eight fulltime jobs per thousand tonnes of agrofuel. Furthermore, the predictions about jobs from processing agrofuels are highly speculative. As previously mentioned in the chapter on second-generation agrofuels, the technology is nowhere near commercialization. Many questions remain about how many jobs would actually be created, how many sustained, where these jobs would be concentrated (i.e. close to refineries at ports) and how many jobs in other sectors would be lost.[10]

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Chapter 7

Is there a link between agrofuel monoculture plantations and human rights violations?

In many areas, the expansion of monoculture production for the world market, is closely associated with human rights violations, often related to health impacts, land conflicts and labour conditions.

Health impacts of soya monocultures
Article 25 in the United Nations Universal Declaration of Human Rights from December 10, 1948, proclaims: *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control*."[1]

The expansion of soya in Argentina and Paraguay for feeding animals in Europe and China, has already, since 1997, directly compromised the human rights of the population in the places where large soy plantations have been established. Now these countries face the additional threat of agrofuel expansion. It is worrying to see that agrofuels are promoted as having the potential to improve the economies of Southern countries, while evidence of the negative impacts is totally disregarded. For example, Hector Huergo, a well known columnist in rural affairs in an Argentinean national news paper, declared: *"soy is the undeniable fate of Argentine agriculture... It must be deforested where possible to grow soy... We should use as much space as possible to capture sun radiation and turn it to energy as for example by biofuels."*[2]

Several violations of Article 25 of the UN's Universal Declaration of Human Rights can be traced to the expansion of soya and oil palm across Latin America and South Asia, but one human right that is commonly disregarded is the right to adequate health. The increase in agrotoxic chemicals and deforestation flagrantly violate the right to a standard of living adequate for health and well-being.

Health impacts of deforestation
Deforestation due to soya expansion in northern Argentina, Brazil and Paraguay is well documented.[3] It is also well-known among epidemiologists that diseases that are classified as zoonotic (caused by contact with animals) and vector transmitted are associated with deforestation. Emerging infectious diseases have a complex causality which includes: population growth, changing patterns of consumption, generation of waste driven by urbanisation, agricultural expansion, and alteration of forest habitats.

The emergence of disease is typically associated with a combination of these factors, but the common factor in all cases is change – relatively abrupt or episodic social and ecological change. Most often, this is reflected in changes to land cover and land use (unplanned urbanisation and land use conversion), agricultural intensification (dams, irrigation projects, factory farms, etc.) and the displacement and migration of people.

Frequently, these diseases are not research priorities until they become a threat to affluent populations. Knowledge about their distribution and biology is often limited. The historical orientation of tropical medicine towards understanding the natural history and ecology of diseases has, unfortunately, been displaced by modern biomedicine, and the mistaken belief that infectious diseases have been conquered by science. One of today's major challenges is to bridge the disciplinary gap between infectious disease researchers, wildlife experts, ecologists, social scientists and local knowledge. The problems are of course compounded by the increasing number of people living in developing countries without potable water, sanitation and adequate public health infrastructure.[5]

Deforestation has many consequences for ecosystems. It decreases the overall habitat available for wildlife species. It also modifies the structure of environments, e.g. by fragmenting habitats into smaller patches separated by agricultural activities and human populations. Increased edge effects (due to a patchwork of varied land use creating many boundaries) promote interaction among pathogens, vectors, and hosts. Evidence is mounting that deforestation and ecosystem changes influence the distribution of other micro-organisms and the health of human, domestic animal, and wildlife populations. [6]

One example from Epidemiologist, Dr. Oscar Daniel Salomón, Director for Centro Nacional de Endemo-Epidemias (CENDIE), Argentina, tells how the expansion of soya during the last five years has led to deforestation and a subsequent emergence of zoonotic and vector borne diseases in northern Argentina.[7] He refers to the urbanisation of leishmaniasis, which used to be a disease of the forest. The effect of deforestation due to soya monoculture is very clear for this disease. Dr. Salomón explains that contacts between wild animals and humans have now become more intensive, due to the loss of wild habitats. The situation deteriorates still further when agricultural areas become urbanised, with dense populations living in extreme poverty, malnutrition and bad sanitary conditions.[8]

Another disease, Hantavirus, is common in rodents concentrated in forest verges and now poses a threat to humans. This is especially a problem with fields that are left fallow, generating *'ratadas'* (rat invasions). This occurs with sugar cane and goes on happening with soya, resulting in a severe sanitary risk. Notified cases of Pulmonary Syndrome due to Hantavirus have increased in northern Argentina since 1996. [9] In the case of Leishmaniasis, the cost of the medicine for treatment in adults is about U$100, plus costs of nursing, disposable syringes and clinical diagnostic systems. Treatment lasts twenty days, during which patients are often unable to work and do not get paid. In the absence of a local nurse, the patient has to travel to the city, resulting in further indirect costs to the affected families.

Additional costs for the Argentinean public health system arise because some neighbouring countries only have private clinics, and patients need to cross the border in search of treatment. Dr. Salomón notes that the benefits of deforestation go to the company, while the cost is borne by the affected people and the State via its health system.[8] Deforestation and subsequent land use and human settlement patterns have coincided with an upsurge of malaria in Africa, Asia and Latin America. Fires and clearance of land for palm oil cultivation in Sumatra are intimately associated with the often fatal Nipah virus normally found in Asian fruit bats. This virus is believed to have crossed over to humans as the bats lost their habitats through forest fires and land clearance.[10]

Health impacts from the use of agrochemicals

In the cultivation of palm oil and soya, the two main raw materials for biodiesel, both paraquat and glyphosate are widely used as herbicides. Paraquat can be fatal if inhaled, ingested or absorbed through the skin. The symptoms of acute paraquat poisoning, namely nosebleeds, eye irritation, skin irritation and sores, nail discoloration/loss and abdominal ulceration are common in palm oil plantation workers.[11] The National Poison Centre at University Sains Malaysia, has documented many cases of lethal poisoning due to paraquat, arising from "normal usage" by workers. From 1977-1997, on average, one Malaysian worker died every four days due to paraquat poisoning.[12]

In 2006, Malaysia, the largest producer of palm oil, lifted a ban on paraquat imposed in 2002. The government justified this in order to allow a study *"...following appeals from farmers and manufacturers to look at the greater uses of the herbicide"*.[13] NGOs, however, accused Malaysian companies, which are members of the Round Table on Sustainable Palm Oil (RSPO) of lobbying for the national ban on paraquat to be lifted. The Malaysian Palm Oil Association, which is represented on the Executive Board of the RSPO, also called for the RSPO standard to be revised, as member companies thought the standard was too high for them.[14]

Indonesia's legislation allows Paraquat to be used only by trained and approved people. However, the training is often minimal and the protective clothing - if provided - impractical. It is also difficult to verify that untrained and uncertified workers are not using the chemical.[16]

The Argentinean Association of No Till Rural Producers, AAPRESID, a member of the Organising Committee of the Roundtable on Responsible Soy (RTRS), promotes aerial spraying of paraquat, fungicides and glyphosate.[17] This organisation is described as an 'environmentally aware producers' organization' by the RTRS. They train their associates to conduct aerial spraying without consideration for the people living at the edges of the soya plantations, and without informing their staff about the impact of the agrochemicals on human and animal health. Glyphosate, the main herbicide used in GM Roundup Ready soy cultivation, though less toxic than paraquat, is used in preparations containing surfactants that are themselves rather toxic. Moreover, glyphosate is not harmless. It can damage human placental cells in concentrations lower than those in agricultural use.[18] There are many documented cases of communities poisoned by cocktails of herbicides in Argentina and Paraguay, mostly through aerial spraying. [19]

In Argentina, a campaign "Stop Fumigating!" has been started jointly by urban and rural communities against the spraying of soya, by which they are surrounded. Glyphosate is sprayed within metres of peoples' homes. A study financed by the Argentinean Ministry of Health, conducted in five towns in southern Santa Fe province, produced some alarming data. According to the Centre for Biodiversity Research, the National University of Rosario, the National Institute of Agricultural Technology and the Italian Hospital of Rosario, there is "very significant incidence" of various forms of cancer and malformation in the area studied. The research, presented in January, showed that in the Santa Fé towns of Alcorta, Bigand, Carreras, Máximo Paz and Santa Teresa there are ten times more cases of liver cancer than the national average, including several birth defects associated with the use of agrochemicals. An outer neighbourhood of the city of Cordoba, Ituzaingó Anexo, was declared a health emergency area after a study done in 2002 by the provincial ministry of health. That study had found higher incidences of leukemia, lupus, skin hemorrhages and genetic malformations.[20]

In addition to concerns about agrochemical spraying on human health, there are issues of water pollution. Herbicides are washed into streams and rivers which provide the only source of water for all household needs of local communities. In Argentina insecticide concentration found in rivers in areas of intensive soya cultivation indicate that aquatic life and communities using that water are at high risk.[21]

Land conflicts and evictions

Monoculture expansion is, on many occasions, directly related to increased land conflicts. Below are just a few examples of how pressure on land increases land conflicts, regularly involving severe human rights abuses. There are, in addition, many well documented cases of violations of labour and trade union rights in plantations.

The clearing of forests to make room for these new crops is putting at particular risk the 60 million indigenous people who depend on forests almost entirely for their survival, according to the U.N. Permanent Forum on Indigenous Issues.

The UN Permanent Forum on Indigenous Issues Sixth session was recently held in New York (14-25 May 2007). Forum chair Victoria Tauli-Corpuz said that “Indigenous people are being pushed off their lands to make way for an expansion of biofuel crops around the world, threatening to destroy their cultures by forcing them into big cities”. She emphasized that some of the indigenous people most at risk live in Indonesia and Malaysia, which together produce 80 percent of the world’s palm oil - one of the crops used to make biofuels.

In one Indonesian province - West Kalimantan - the U.N. has identified 5 million indigenous people who are likely to be displaced because of biofuel crop expansion. ‘The speed with which this is happening we don’t really realize in our part of the world,’ Ida Nicolaisen, an expert in indigenous cultures and member of the U.N. forum, who has studied violations of indigenous people in Sarawak, Malaysia, said at a news conference. ‘Because the technology we have today and the economic resources that are at stake are so big, it happens overnight.’

In Colombia, paramilitary and military forces are acting together to violently force indigenous populations out of certain areas in order to expand oil palm plantations. Many are being displaced and their land is illegally appropriated. An international campaign has been established to expose oil palm expansion in Colombia, the “Campaña Internacional por la Vida del planeta no al consumo de biocombustibles del Chocó Colombia.”[22]

The DAABON group, a member of the RSPO, is producing palm oil in zones where murders and even massacres are associated with land appropriation. Nevertheless, the DAABON group is cultivating a green image, marketing organic palm oil products. [23] In Paraguay, soya plantations are expanding, and already now cover around 60% of all land under cultivation. This expansion goes hand in hand with displacement of smallholders. Under the government of Nicanor Duarte Frutos, repression of organisations defending the rights of smallholders and landless people has increased to alarming levels. In August 2006, the coordinating body of Paraguayan smallholders, MCNOC, released a statement saying that they were in a state of permanent mobilisation. They have been organizing land occupations with landless families.

According to MCNOC, since Nicanor came into power, “...more than 2000 peasant leaders got charged, and more that 15 peasant leaders were murdered.’’ [24] That August, land evictions took place in areas where soya expansion had been intensifying. In a community in San Pedro, 90 families have been struggling for five years to keep hold of 1001 hectares of arable land. Several times they have been injured, evicted, and imprisoned. On the morning of August 9th, hundreds of riot police and gunmen of Paraguayan landowner Calixto Saguier, beat and arrested settlers and burned their houses. They destroyed 600 hectares of subsistence crops, in the presence of the district attorney. In September 2006, the Paraguayan Supreme Court confirmed that the national land reform institution INDERT has been illegally selling an unknown quantity of public land to large soya producers.

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Chapter 8

Do current 'sustainability certification' initiatives for biomass/agrofuels form a real and credible solution?

The grave concerns about the social and environmental impacts of growing demand for agrofuel commodities like palm oil and soya, have led to a perceived need for some kind of 'sustainability certification' scheme for biomass/agrofuels. Various voluntary certification schemes have been developed, or are being developed, to try and improve production practices of commodity products. The case of agrofuel production is different however, in the sense that a new market is being created artificially, on environmental grounds, with the help of government incentives, targets and subsidies. Certification is proposed as a means of justifying this public support. Sustainability certification of biomass/agrofuels has therefore become a key issue in the current agrofuel debates both within the EU, and internationally.

Various initiatives to develop the necessary 'sustainability criteria' for agrofuels are now being set up in order to facilitate quick penetration of agrofuels into the market. The UK[1], the Netherlands[2] and Germany are all undertaking projects to develop criteria for the sustainability of biomass/agrofuels. The European Commission has been developing 'sustainability safeguards' for the revised Biofuel Directive.[3] However, the three criteria proposed only cover two issues; GHG balance and high biodiversity value areas.

In addition, a project by Lausanne University (EPFL) has joined with WWF, the World Economic Forum, major oil companies, among others, in a 'Round Table on Sustainable Biofuels'.[4] There are numerous industry initiatives, e.g.: the Climate, Community & Biodiversity (CCB) Standards with Conservation International; Daimler Chrysler-UNEP sustainability criteria for biomass cultivation for biofuels.

There is an important difference to be made between *voluntary* certification initiatives, such as FSC and RSPO, that depend for their success on conscious consumers choosing to buy a certified product; and *mandatory* certification, which comes down to setting environmental and social standards for an entire product sector.

Key questions are:

1. To what extent can certification schemes effectively address the problems identified? Should they be voluntary or mandatory?
2. Who is involved in deciding what biomass/agrofuels deserve the label 'sustainable'?
3. Will (voluntary / mandatory) sustainability certification for agrofuels be tolerated under WTO trade rules?

Certification as a tool
Regarding the first question, it is widely agreed that certification schemes alone, and in particular voluntary ones, cannot solve all problems related to the large scale production of biomass/agrofuels. Most importantly, certification cannot prevent impacts taking place at the macro-level, like the displacement of production to elsewhere (also called 'leakage'). Ultimately, the large scale production of agrofuel crops will mean an overall expansion of production area. Future certified palm oil, for example, might be produced from land deforested several years previously, while forest continues to be cleared for palm oil for other markets. Increased price levels for food, oilseeds, grains, and land, are another area of concern. A report by the Food and Agriculture Organisation shows that the increased use of European rapeseed oil for biodiesel is one of the main factors for the rise in palm oil prices, and, in turn, for palm oil expansion.[5]

Other major obstacles include:

- Large players are much more able to meet certification demands than small scale producers, and can do it in a more cost effective way.
- Producers and traders can serve both the certified market and at the same time continue bad practices elsewhere, while still benefiting from the green image.
- Corruption, repression and lack of monitoring, especially in the case of tradable certificates
- In some countries, like Paraguay and Colombia, human rights are abused to such a level that any 'sustainability' label would meet widespread opposition from civil society.
- The more credible a system, the higher the costs involved, decreasing its competitiveness
- In the case of mandatory blending of agrofuels in all or most fuels, voluntary certification would be useless since there is no choice for consumers at the pump station.
- As for greenhouse gas balances, the current margins of uncertainty, even at the micro-level, are currently too high for meaningful certification based on life-cycle emissions.

Southern stakeholder participation
Invariably, all the initiatives mentioned above have failed to include major stakeholder groups in the South from the outset, particularly those groups affected by

monoculture expansion. This lack of participation leads to overlooking or ignoring certain problems, or proposing inappropriate indicators or criteria. Most importantly, conflicts of interest will become apparent, and these will not be removed by excluding these groups or only involving them after the main criteria setting process has already happened.

These new initiatives often draw heavily on existing initiatives for voluntary certification like the Round Table on Sustainable Palm Oil (RSPO) and the Round Table on Responsible Soy (RTRS) despite lack of support, or outright rejection of those initiatives by a large share of civil society in producer countries. Many organisations in those countries have refrained from participating in these round tables, precisely because of their voluntary nature and the fact that such schemes do not limit the expansion of plantations. When using the results of these initiatives for the development of new ones, these points of view are not taken into account.

WTO rules

There is a great deal of uncertainty as to whether mandatory or even voluntary certification is tolerated by WTO trade rules. Agrofuels have not yet even been uniformly classified under the WTO system, i.e. whether they are treated as industrial, agricultural or environmental goods. Voluntary certification is only allowed provided there is free competition among different labels, and if no measures are taken to prohibit trade in non-certified goods. Mandatory certification is seen as very hard to achieve. An internationally agreed set of standards is therefore often mentioned as the only way to avoid WTO challenges by producer countries.

Will current initiatives guarantee sustainability?

It should be emphasized that the more advanced initiatives at the EU level have all been strongly criticised. All recognise the existance of macro-impacts such as displacement, but their implementation is not conditional on adequately addressing them. Also, none of the initiatives takes affected groups in southern countries into consideration, or has consulted them. The approach now taken by the European Commission is highly minimalist and does not provide any guarantee of even the most limited interpretation of 'sustainability', excluding in the process all social and most environmental issues. Finally, some of these criteria setting processes (i.e. the UK and Dutch criteria for agrofuels for transport) will only be used for mandatory reporting purposes for the time being, *not* mandatory certification. So in those countries, in the coming years *no* agrofuel will be excluded from receiving support or from counting towards the target, regardless of its sustainability performance and even if it has a negative GHG balance.

Conclusion

The outcome of the international discussion on 'sustainable' agrofuels will have a great impact on future biomass production in both qualitative and quantitative terms. Discussions in this respect only make sense, however, if:

(1) It is recognised that certification schemes alone, even if mandatory, are unable to deal with some major negative impacts, especially at the macro-level. In addition, in some countries certification as a tool is not likely to work. It is crucial therefore that strong efforts are made to reduce consumption of energy and raw materials, especially in northern countries. There is a great need to reduce, not increase, the total demand for palm oil, soya, sugar cane and other monoculture crops. Thorough environmental and social impact assessments must be made to investigate the true costs to societies and ecosystems of the expansion of monoculture production in general.

(2) All stakeholders, especially groups in societies affected by monoculture expansion, must be involved in this process, and in the impact assessments, otherwise the outcomes will not have any legitimacy, and may label the unsustainable as 'sustainable'.

(3) It is recognised that the WTO framework, as it has been created through negotiations dominated by economically powerful countries, forms a major obstacle to any attempt to solve the massive problems associated with large scale monoculture production.

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Chapter 9

Will the voices of experience, resistance and opposition from the South be heard?

The expansion of monocultures in the global South has been reinforced by the added aim of producing feedstock for agrofuels. However resistance is growing, especially in Latin America and Asia. Groups do not merely wish to mitigate the harm caused by monocultures, they want to question the entire intensive agriculture system underpinning them. Grassroots groups seeking to defend agriculture for food sovereignty are mobilising throughout both regions and resistance is also building in Africa.

The resistance takes various forms, e.g. new urban-rural cooperation between activists, land occupations by landless people, court cases, and even destruction of monoculture crops. There are many examples. In March 2006, a group of some 2000 women from Via Campesina uprooted eucalyptus seedlings on a plantation belonging to the giant pulp conglomerate Aracruz Cellulose in Rio Grande do Sul, Brazil. Fast growing (GM) trees are also seen as a future supplier of agrofuels.[1] Supported by an international pressure campaign, two important court cases were won at the Supreme Court in Paraguay in 2006, one of which involved the conviction of two soya farmers for causing the death of 11-year old Silvino Talavera by Glyphosate spraying.

New coalitions are being shaped between urban and rural organisations, like the Foro de Resistencia a los Agronegocios.[2] The Stop Fumigating! campaign unites urban and rural communities against agrochemical spraying of GM soy fields surrounding them. [3] Pesticide Action Network, Asia Pacific region (PANAP) has a strong focus on the use of Paraquat in oil palm plantations and its impact on women workers.[4]

In South Africa, groups are monitoring developments such as a project for half a million hectares of the Eastern Cape farmers Homelands to be turned over to the production of rapeseed for processing in a trade zone by German companies and exported to the EU.[5] A more detailed report is forthcoming. The Africa Centre for Biosafety stated in February 2007: *"Whilst we welcome the need to address our dependence on fossil fuels, our modes of consumption and production and its concomitant environmental and socio-economic problems, we state at the outset that we are opposed to the notion that large- scale liquid biofuels should be considered as part of the renewable energy package of solutions for South Africa. We are particularly opposed to biofuels produced from agricultural plantations, food and genetically modified crop plants and trees."*

At the same time, groups are producing declarations that set out their positions on the issues. Many groups have signed up to the Open Letter to the EU institutions and citizens 'We Want Food Sovereignty Not Biofuels' by Latin American organisations.[6]
"In order to serve the soybean business, the governments of the Southern countries are building dams, waterways, bridges and highways with the consequent negative impacts on the environment. At the same time, the expansion of soybean crops is affecting the health of surrounding populations, where the levels of cancer and other diseases associated with agro toxic chemicals used on these monoculture plantations are increasing day by day. Sugar cane plantations and the production of ethanol in Brazil are the business of an agricultural monopoly using slave labour, and oil palm plantations are expanding at the expense of forests and the territories of the indigenous and other traditional communities of Colombia, Ecuador and other countries, increasingly geared to biodiesel production." The Enwene Nawe indigenous people in the Mato Grosso declared, "Soybeans are killing us." At this time, some scant 429 Enawene Nawe people still survive. Their territory has been reduced to half its size and they are surrounded by soybean plantations. Their health is declining and the children suffer from malnutrition."

Many have signed up to the Declaration 'Biofuels, a Disaster in the Making'[7] to the parties to the UN Convention on Climate Change (Nairobi, November 2006), calling a halt to, *"all subsidies and other forms of inequitable support for the import and export of biofuels"*. This letter also notes, *"We recognize that the local production and consumption of biomass plays an important role in sustainable livelihood strategies of, in particular, rural women in developing countries. Certain small-scale and strictly regulated sustainable forms of biofuel production can be beneficial at the national level."*

SawitWatch (Indonesia), has published an Open Letter to the EU institutions expressing their, *"deep concern over the policies being adopted to favour the use and import of biofuels as an alternative to fossil fuels, whose disproportionate use is one of the new driving forces of large-scale and monoculture oil palm plantation expansion that contributes to global warming, social conflicts and rights abuses in producing countries, particularly Indonesia."*[8]

A declaration about sugarcane in Brazil 'Full Tanks at the Cost of Empty Stomachs: The Expansion of the Sugarcane Industry in Latin America',[9] February 28th 2007, by Comissão Pastoral da Terra (CPT), Grito dos Excluídos, Movimento Sem Terra (MST), Serviço Pastoral dos Migrantes (SPM), Rede Social de Justiça e Direitos Humanos and Via Campesina, begins by saying: *"The current model of production of bioenergy is sustained by the same elements that have always caused the oppression of our peoples: appropriation of territory, of natural resources, and the labor force…Biomass is falsely presented as the new energy matrix, the ideal of which is renewable energy. We know that biomass will not actually be able to substitute fossil fuels, nor is it renewable."*

Conclusion

Increasing numbers of groups from the global South are rejecting the push for more monoculture and agrofuels production. They are questioning the model of industrial agriculture that is, once again, helping to destroy their livelihoods and displace them from their land, with profoundly negative implications for food sovereignty, sustainable agriculture, biodiversity, climate stability, as well as indigenous and local community rights and knowledge. That this is being done in the name of addressing climate change by substituting agrofuels for a small proportion of fossil fuels is particularly ironic. It is vital to heed these calls and re-examine the paradigm that proposes agrofuel monocultures as a solution before taking any more risks with biodiversity, climate and the resources on which we all rely, of human experience and intergenerational knowledge.

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- Second Generation Agrofuels: How do unproven promises of future technological fixes shape the present debate?
- How will large scale agrofuel production affect biodiversity?
- Does the structure of global agrofuel production threaten food security?
- What is the real impact of agrofuels on rural development and jobs?
- Is there a link between agrofuel monoculture plantations and human rights violations?
- Do current 'sustainability certification' initiatives for biomass/agrofuels form a real and credible solution?
- Will the voices of experience, resistance and opposition of the affected groups from the South be heard?

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