AGROFUELS ARE NOT LOW-CARBON

RAINFOREST ACTION NETWORK'S ANALYSIS OF INDUSTRIAL BIOFUELS

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RAINFOREST ACTION NETWORK

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Introduction

Global agrofuels production is experiencing explosive growth. World production of fuel ethanol – which constitutes the vast bulk of global agrofuels production – rose from 17.5 billion liters in 2000 to 66.5 billion liters in 2009, an increase of 280 percent in nine years.[1,2] In the United States, politicians, agricultural interests, and the media have heralded agrofuels as a means to decrease U.S. foreign oil dependency, support domestic agriculture, lessen air pollution, and fight climate change.

A closer look, however, reveals another more alarming side to the agrofuels explosion – increased tropical deforestation, higher global warming emissions, escalating food prices, growing hunger for the most vulnerable populations, eroding land rights and worsened food security.

By ignoring these impacts and promoting agrofuels as a solution to global warming and as a green alternative to our dependence on oil, agribusiness companies are deceiving consumers and distracting politicians from policies that promote true solutions. In 2008, U.S. drivers consumed an average of 378 million gallons of gasoline every day.[3] There is simply not enough land to grow enough biomass-based fuels to displace the U.S. demand for transportation fuel, much less the growing global demand for fossil fuels.

True solutions offer a different path towards a people-led, renewable energy revolution, which ensures the rights of peoples and communities to determine their own food and energy systems; protects forests and other natural ecosystems; reduces our energy consumption through efficiency and conservation; expands mass transit; creates bike- and pedestrian-friendly cities; plugs vehicles into sustainable, renewable energy; and halts the expansion of carbon-intensive industries.

What are Agrofuels?

Because the idea of fuel from plant stocks is so new, there is significant confusion in the public surrounding terms such as agrofuels, biofuels, biodiesel, ethanol and cellulosic ethanol. For the purpose of this paper, we are defining agrofuels as fuels made through an industrialized process from dedicated agro-crops or from biomass-based feedstock. This would include ethanol from corn and sugarcane (a substitute for gasoline), biodiesel made from the oil of a plant (a substitute for diesel fuel) and cellulosic or second-generation biofuels, including those made from genetically modified biomass such as algae, jatropha or genetically engineered trees. The focus on this paper is on dedicated agrofuel crops, and not on biodiesel made from recovered waste vegetable cooking oils in local non-industrialized processes.

In the U.S. today, 99 percent of all agrofuels are derived from corn and soy, generally mixed as ethanol into gasoline or used as diesel fuel. Production of these fuels has already exceeded 2012 targets of 7.5 billion gallons per year and continues to expand. Since 2001, the amount of corn grown to produce ethanol has tripled in the U.S., from 18 million tons to 55 million tons in 2006.[4] In Europe, the agrofuels market is primarily based on biodiesel, sourced from oilseed crops like oil palm, rapeseed and soybeans.[5]

Production of agrofuels around the world has existed for many years, but investment and production of agrofuels increased dramatically from 2006 to 2008 because of growing concerns around high fossil fuel prices, predicted peak oil, and climate change.[6] Governments in particular seem to view agrofuels as an easy solution to the need to phase out fossil fuels. By 2008 more than 20 countries had established mandates for increasing the production of agrofuels over the next decade.[7]

In 2004, an estimated 14 million hectares of land worldwide were being used for agrofuels production.[8] Since then, global fuel ethanol production has increased from 32.0 billion liters in 2004 to 66.5 billion liters in 2009 – and global biodiesel production has increased by an even greater percentage.[9,10] In 2009, estimates project that at least 29 million hectares – or 112,000 square miles – are being used worldwide for agrofuels production, an area greater than the total amount of arable land in France and the United Kingdom combined.[11]

In May 2009, Obama Administration EPA Director Lisa Jackson stated that "using more homegrown biofuels reduces our vulnerability to oil price spikes that everyone feels at the pump … and protects the planet from climate change in the bargain."[12] In a country that imported 677 million barrels of oil in 2008, and with oil consumption contributing nearly 45 percent of U.S. CO_2 emissions, agrofuels seem to some politicians like an opportunity to mitigate climate change.[13,14,15]

Lisa Jackson's comments reflect public opinion. A national poll conducted by the University of Wisconsin in 2009 showed that 67 percent of respondents were interested in learning more about agrofuels, and that most had a positive view of them: 66 percent agreeing that using agrofuels could help the United States reduce reliance on foreign oil. Another 53 percent believed agrofuels can have a positive impact on climate change trends by reducing greenhouse gas emissions.[16]

But is it true? Do agrofuels really wean us off our addiction to oil and reduce global warming emissions?

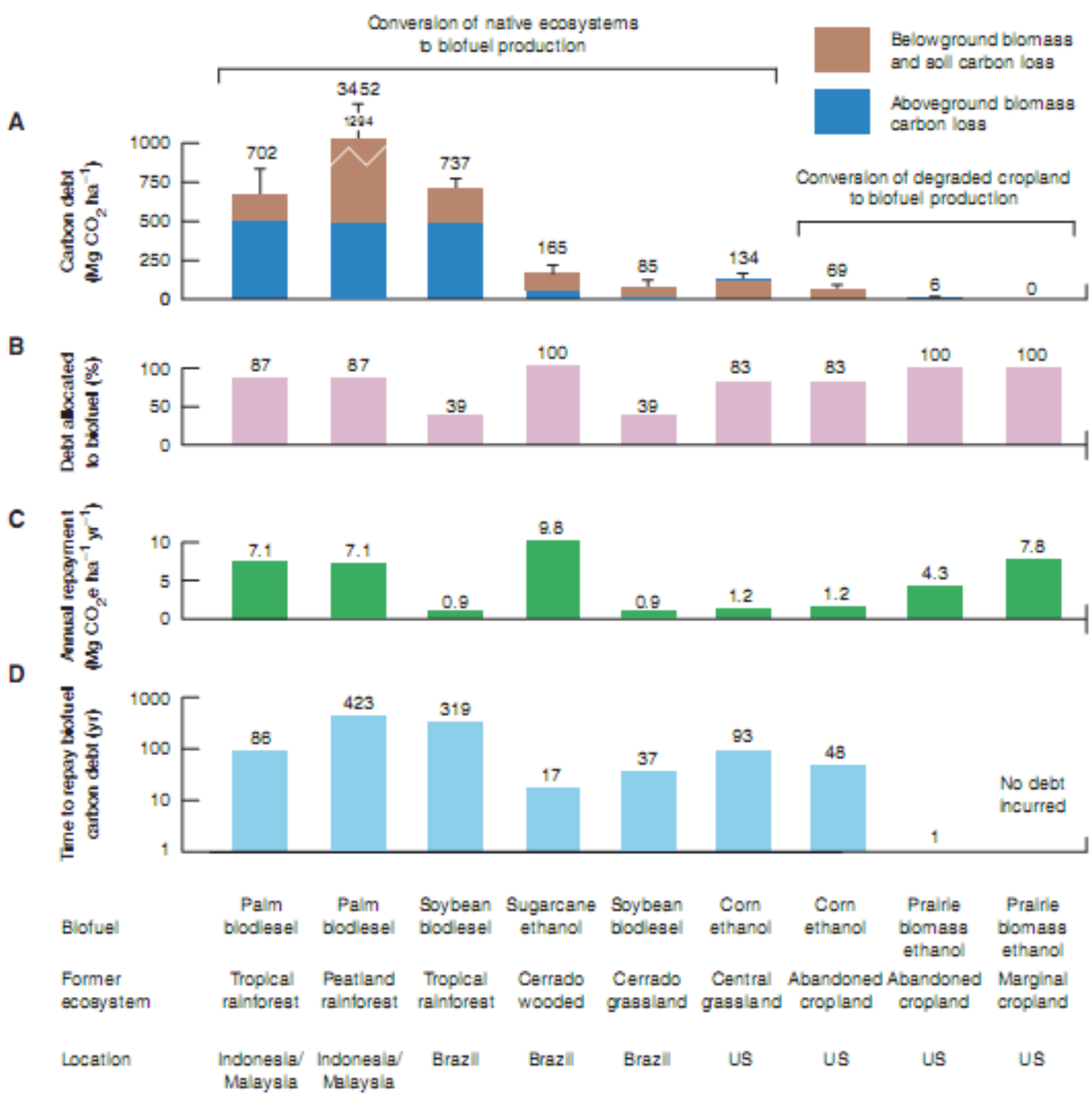
Climate impacts: Agrofuels are not low carbon

Several recent academic studies, incorporating calculations of land-use change, have profiled the alarmingly poor record of agrofuels on carbon emissions relative to petroleum:

- Searchinger et al, in an article published in Science in 2008, calculated that – when the effects of land-use change are included – corn-based ethanol production results in 93 percent more carbon emissions compared with petroleum over a thirty-year period.[17]
- Danielsen et al, in a forthcoming article in Conservation Biology, calculate that palm oil-based agrofuels produced on cleared rainforest land – which has accounted for the vast bulk of the recent expansion in palm oil-based agrofuels production – would result in a negative carbon balance for the first 75-93 years of production compared with petroleum, and that palm oil-based agrofuels produced on cleared peatlands would take around 600 years to result in a positive carbon balance.[18]

- Fargione et al, in an article published in Science in 2008, calculated the time it would take for agrofuels production in different habitats to offset the negative carbon balance that would be created by land clearing. They found that sugarcane-based ethanol, produced in cleared Brazilian cerrado lands, would take 17 years to have a positive carbon balance; corn-based ethanol, produced on cleared U.S. grasslands, would take 93 years; palm oil-based biodiesel, produced on cleared Indonesian rainforest, would take 86 years; palm oil-based biodiesel from cleared Indonesian peatlands, would take 423 years.[19]

Table 1: Biofuel carbon debt, debt allocated to biofuel, annual repayment rate, and years to repay biofuel carbon debt. One key finding: it takes 423 years to pay back the carbon debt if you use palm oil sourced from cleared peatland forests in Indonesia.



Energy Impacts: it takes fossil fuels to make agrofuels

Recent research has called into question the purported net energy of an expanded reliance on agrofuels. A study conducted at Cornell and the University of California – Berkeley by Pimentel & Patzek found that it takes nearly 30 percent more fossil fuel energy to produce enough corn-based ethanol to replace one liter of gasoline than if that liter of gasoline was simply burned.[20] The researchers found that earlier studies on agro-fuels had failed to consider:

- Nitrous oxide emissions from agriculture. N_2O has 296 times the global warming potential of CO_2, and is an important pollutant from use of high doses of nitrogen fertilizers for large-scale, monocrop agricultural production of corn and other industrial crops. Furthermore, chemical fertilizer application in the tropics can cause 10-100 times higher relative N_2O emissions compared to fertilizer application in temperate zones – and it is precisely in the tropics that much of the recent increase in industrial agrofuels feedstock production is taking place. Nitrogen-based fertilizers are also extremely energy intensive: over 30 percent of the total energy used in the corn production process goes solely into producing N_2O fertilizers.[21]

- Petroleum-based fuels used in the agrofuels production process. In their study of corn-based ethanol production, Pimentel & Patzek point out that, on an average U.S. farm, 40 liters of gasoline or diesel are used to grow enough corn to make 1,000 liters of corn-based ethanol. However, the true amount of fossil fuels used in agrofuels production is much higher, as this amount does not include the gasoline or diesel used to transport corn from the farm to the ethanol refinery, to transport ethanol from the refinery to retailers, and to transport various other inputs involved in corn and ethanol production.[22]

- Petroleum-based herbicides and insecticides used in agriculture. In the U.S., on average, 6.2 kg of herbicides and 2.8 kg of insecticides are used to produce one hectare of corn. These chemicals are usually petroleum-based, and their production process is highly carbon-intensive.[23]

- Steam and electricity used in the ethanol refining process. Ethanol refining is a highly energy-intensive process, requiring on average 392 kWh of electricity, and 2.5 million kcal of steam to produce 1,000 liters of corn-based ethanol.[24] Electricity production in U.S. farm states is particularly dependent on coal, the worst fossil fuel from a climate perspective.

- Land use change and deforestation. As demand for agrofuels rises – and they become more profitable, land that was once untouched forest or grasslands is converted to crops like soy, oil palm or sugar cane that can be used to produce agrofuels.

Agrofuels: driving tropical deforestation

There are two ways that agrofuels drive tropical deforestation, both directly through conversion of forests for agrofuel crops such as palm oil, through indirect land use change. The E.U. is a good place to start explaining the direct impacts, where in 2006 mandate was passed calling for 5.75 percent of all transport fuels to come from "renewable" sources by 2010. The European agrofuels industry used this opportunity to dramatically increase low-cost palm oil imports.[25] Consequently, palm oil production in Indonesia exploded: production is expected to hit 21.5 million tons in 2009, up from 14.1 million tons in 2005.[26,27] In Indonesia, the palm oil industry plans to add another 4 million hectares of palm oil plantations – an area the size of Switzerland – solely for the purpose of agrofuels production by 2015.[28]

In response to public awareness campaigns about the consequences in tropical regions for the European biofuels mandates, the policymakers responded by pushing the UK target of fuelling 5 percent of vehicle traffic with agrofuels back from 2010 to 2013-14.[29] In September 2008, the E.U. followed suit, mandating that only 6 percent of E.U. transport fuels come from crop-based biofuels by 2020; the remaining 4 percent would come from "other renewable sources," including electricity, hydrogen, and "second-generation biofuels."[30] However, Indonesia's plans for clearing land for oil palm remain the same, anticipating that mandates or markets for palm oil biodiesel will grow elsewhere, including in the U.S.

Globally, the most greenhouse gas intensive of all agrofuels comes from palm oil production on peatland. Of all tropical peatland, or swamp rainforests, the region of greatest concern in 2009 is the Sumatran province of Riau. The peatlands of Riau are some of the highest-carbon areas on Earth. They cover about half of Riau, and of Riau's total peatland base of 4 million hectares, 3 million hectares are earmarked for palm oil development over the next decade,[31] about three quarters of peatland forests under threat in all of Indonesia. Page et al estimate that burning a hectare of peatland forests releases, on average, at least 1,217 tons of CO_2.[32] Thus, burning 20 hectares of peatland – enough to produce 100 tons of palm oil-based biodiesel per year – releases at least 24,340 tons of CO_2.[33,34] Burning all 4 million hectares of peatland in Riau in order to replace them with palm oil plantations would release at least 4.87 billion tons of CO_2 – which is the equivalent of almost half of one year's worth of CO_2 emissions from petroleum in the entire world.[35] Clearly, burning peatland to grow palm oil for agrofuels is not a solution to climate change – and yet the political push from the biofuels industry, the failure to protect carbon sinks like peatlands in Indonesia, and a legitimate, growing realization that we need to reduce our dependence on petroleum have given all biofuels a green reputation despite the fact that palm oil biodiesel has devastating impacts on climate change.

Land-use change overall – and its effects on the planet's CO_2 levels – is a major driver of climate change, responsible for 20 percent of global greenhouse gas emissions, roughly the same level of emissions as the entire global transportation sector. Agrofuels expansion is in turn a major driver of land use change. Beyond direct impacts of land use change from converting land into energy crops, a significant, unaccounted source of emissions comes from indirect land use change, or the consequences of displacing food crops in one region with energy crops, leading to increased clearing in other regions. Indirect land use change accounts for higher pollution as well loss of biodiversity and also has had a recent and notable impact on escalating food prices.[36]

If a farmer in Kansas grows an agrofuels feedstock, switching his soy field into corn to profit from higher ethanol prices, then somewhere in the world, another farmer will grow soy to fill the market demand. When U.S. mandates for corn ethanol drive a significant conversion of existing farmland to agrofuels production, the logic of the global market sends demand to another of the world's soy baskets: the Amazon, where agribusiness companies encourage the clearing of carbon-storing tropical rainforest in order to grow soy to make up for the lost American supply. Additionally, the overall decline in food production drives up global food commodity prices, which makes it more profitable for farmers to clear forested land in order to increase production.

As a result of direct and indirect land use changes, the global area of farmland devoted to agrofuels production is both massive and rapidly increasing. In 2004, an estimated 14 million hectares of land worldwide were being used for agrofuels production.[37] Since then, global fuel ethanol production has increased from 32.0 billion liters in 2004 to 66.5 billion liters in 2009 – and global biodiesel production has increased by an even greater percentage.[38,39] Thus, it is possible to estimate that in 2009, at least 29 million hectares – or 112,000 square miles – are being used worldwide for agrofuels production. This is a massive amount of land – slightly greater than the total amount of arable land in France and the United Kingdom combined.[40]

Impacts on Land Rights and Human Rights

Land-use changes from increased agrofuels production not only create increased CO_2 emissions – they also result in land conflicts, human rights abuses, escalating global food prices and increased food insecurity and hunger.

- At the U.N. Permanent Forum on Indigenous Issues in May 2007, chair Victoria Tauli-Corpuz, a member of the Igorot Indigenous group from the Philippines, stated 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." This violation of Indigenous peoples' land rights is particularly widespread in Indonesia and Malaysia, especially in the Indonesian province of West Kalimantan, where the U.N. warns that 5 million Indigenous people are at risk of being displaced as a result of increased agrofuel crop production.[41]

- A report by Friends of the Earth details the problematic relationships that Wilmar, a major oil palm producer linked to U.S. food giant Cargill, has had with the communities of Desa Senujuh in West Kalimantan, Borneo. Between Nov. 2005 and March 2006, Wilmar began clearing lands for palm oil plantations, without obtaining all necessary permits – but also illegally clearing lands outside the area that the permits they had applied for would have allocated to them, including Senujuh's common rubber gardens. After community members confiscated several of the company's chainsaws and filed a formal complaint with the local parliament, Wilmar's manager apologized, paid traditional reparations, and agreed to stop clearcutting in Senujuh. However, in April 2006 – without consulting the community – rights to most of Senujuh's lands were granted to the Ganda Group, which is owned by the brother of Wilmar's CEO.[42]

- A comprehensive survey of palm oil development in Sarawak (a Malaysian province on Borneo) included a survey of residents of three Penan Indigenous communities. The community leader of Long Singu, Alung Ju, stated that "there has been no consultation until now with my people of Long Singu. Some [fallow plots], fruit trees and burial sites were damaged and destroyed but no compensation given. … The company just proceeded with its operation in our area and did not inform us of the extent of the area to be opened up." Likewise, Lian Bue', the community leader of Long Pelatan, stated that "the company told us that our community is not allowed into reserved forest [and said] all the area must be logged because [the company] has been issued a license. … The company people told us that we had no right to the lands, but we have been here for generations." Many community members that were interviewed expressed fear for the future of their communities.[43]

- In Brazil, reports of debt peonage reached record numbers in 2008, with 5,266 people being freed by federal authorities from work conditions that the government has described as "slavery." Forty eight percent of them were working on sugarcane farms, which "drives Brazil's much-lauded production of ethanol."[44] In June 2007, the Brazilian government freed 1,108 workers from a single sugarcane plantation in the Amazon province of Pará – owned by ethanol producer Para Pastoril e Agricola – who had been working under slavelike conditions. Laborers worked up to 13 hours per day, were paid as little as $5 per month, were malnourished and often had no access to water.[45]

- Apart from the direct use of Amazon-farmed soy and palm oil for agrofuels production, the Brazilian agrofuels-driven boom in sugarcane production is also indirectly causing rainforest destruction, by pushing soy farmers out of the unique Brazilian savannah and into the Amazon. Membeca Farm in Brasnorte, Mato Grosso, has been invading Manoki Indigenous lands, as documented by anthropologist Rinaldo Sérgio Vieira Arruda – in violation of the Brazilian Constitution, under which the Manokis' 206,000-hectare territory is ostensibly protected. While claiming to recognize their territory, the Brazilian government has failed to adequately demarcate and protect the Manokis' lands, thus leaving the Manoki open to land grabbing by Membeca Farm; according to Vieira Arruda, "everything has been done [by the government] to create difficulties in the demarcation process. In the meantime, soya has spread into the Manoki territory and the prospect of a fair solution for them seems more and more distant." The soy from Membeca Farms taken by truck to Porto Velho, and then exported by Cargill and Grupo André Maggi.[46]

In addition to land use and displacement, agrofuels have been cited as one of the key drivers of the emerging global water crisis, predicted to leave half the world's population in areas of acute water shortage by 2030.[47] On average, about 2500 liters of water are needed to produce 1 liter of agrofuel. Implementing current national agrofuel mandates and policies will require an additional 30 million hectares of cropland and 180 cubic kilometers of extra irrigation water. Agrofuels policies rarely account for water impacts or correlate to water policies from the supply region, which will lead to greater competition for increasingly scarce resources.

Fueling hunger: Agrofuels and escalating prices of food

Agrofuels have also been implicated as a key driver of rising food prices. Global food prices rose 83 percent between 2005 and 2008 – pushing the number of people worldwide living in food insecurity to a record 862 million.[48] At the height of a global food shortage in early 2008, the World Bank estimated in an unpublished study that agrofuels had caused an astonishing 75 percent increase in global food prices, a figure that stunned even the most vocal agrofuels critics.[49] This dramatic rise in food prices is a result of many factors – one of which is agrofuels. A Food First policy brief in 2008 gives context to the growing link between hunger and agrofuels.

> "The mainstream conventional wisdom claims that the food crisis is a combination of increasing global population, rising meat consumption in China and India, and soaring oil prices. In this quantitative view, agrofuels plays only a partial role. But this reasoning ignores the driving industrial forces behind agrofuels: big grain, big biotech, and, yes, even big oil. Industrial agriculture dominated by multinational corporations is largely responsible for creating a skewed global food system in which 1 billion suffer from obesity while 840 million people go hungry. As the food crisis worsens, these corporate interests not only profit, they increase their global control over food and the resources needed to produce it. Agrofuels play a central role in increasing the market shares and articulating the market power of the same corporations of the industrial agri-foods complex that created the crisis in the first place."[50]

Second-Generation Agrofuels: miracle or mirage?

These criticisms of agrofuels have begun to register with policymakers and the media in both the U.S. and Europe. Public criticism of agrofuels in Europe began earlier, and has been more vocal. In January 2008, after widespread media reports about the effects of the agrofuels expansion on climate change and rainforest destruction, the E.U. began to rethink its mandate that 10 percent of transportation fuels come from "renewable" sources by 2015; E.U. Environment Commissioner Stavros Dimas stated that "we have seen that the environmental problems caused by biofuels and also the social problems are bigger than we thought they were."[51] In July 2008, the UK pushed its target of fuelling 5 percent of vehicle traffic with agrofuels back from 2010 to 2013-14.[52] In September 2008, the E.U. followed suit, mandating that only 6 percent of E.U. transport fuels come from crop-based biofuels by 2020; the remaining 4 percent would come from "other renewable sources," including electricity, hydrogen, and "second-generation biofuels."[53]

In the U.S., criticism of agrofuels has been slower and less vocal, but has increased in the past year. In early 2008, the mainstream U.S. media began reporting on the negative carbon balance of agrofuels.[54,55] In April 2009, California air regulators passed a statewide Low Carbon Fuel Standard – which included indirect land use change in its calculations of agrofuels' carbon balance.[56] In May 2009, the Obama Administration proposed a draft rule on a federal

Renewable Fuel Standard, aiming to limit emissions of greenhouse gases from the production of ethanol – which is expected to curtail corn-based ethanol production.[57]

In response to these criticisms, policymakers are increasingly pushing for "second-generation biofuels" to replace corn-based ethanol. In May 2009, U.S. Energy Secretary Stephen Chu, while announcing $786 million in funding for second-generation agrofuels research, stated that, "developing the next generation of biofuels is key to our effort to end our dependence on foreign oil and address the climate crisis."[58]

"Second-generation biofuels" is a term for a wide category of agrofuels that do not directly use food crops as their feedstocks. It includes:

- Ligno-cellulosic feedstocks from agricultural waste: Created using biomass from woody or fibrous plant materials, one major potential source for ligno-cellulosic agrofuels would be agricultural and logging waste – such as cereal straw, wheat chaff, rice husks, corn stalks, sugarcane bagasse, nut shells, and wood residues. The IEA estimates that annual worldwide production of the cellulosic feedstocks is 10-50 billion tons per year – but that "only a small portion of this could be utilized in practice." In most cases, these agricultural residues would have to be harvested separately, adding to the cost of harvesting.[59]

- Ligno-cellulosic feedstocks from new biomass: A great deal of research has thus far gone into growing new energy crops, particularly perennial grasses (such as elephant grass, switchgrass, or prairie grass) and short-rotation forest species (such as Eucalyptus, poplars, or locust trees). Genetic modification of such plants to make them even more fast-growing is another avenue that is being explored.[60]

- Jatropha: Sometimes known as the physic nut, Jatropha is a non-food oilseed species that would be planted "in semi-arid climactic zones with marginal soils." Jatropha has also already attracted a significant amount of investment, especially in China.[61]

- Algae: Algae is the fastest-growing plant on earth, and stores large amounts of oil. It develops oil best in open ponds, such as sewage ponds, rather than in closed photo-bioreactors. A large amount of research has also been put into algae as an agrofuel feedstock – but the fact that it is still at the research & development stage causes it to be referred to as a "third-generation" agrofuel. A key problem with algae, according to the IEA, is that, in order to "produce large oil volumes, large surface areas of ponds are involved."[62] The environmental consequences of such a water-dependent feedstock vary widely depending on the local scarcity of water.

Concerns around these feedstocks include the amount of land that would still be needed to produce enough biomass to create a sustainable fuel source, the massive amount of genetic engineering needed to create them and the fact that these plant technologies may actually be more hype than fact. A key concern with second-generation agrofuels is whether or not they will be able to be commercially developed in the near future, in time to meaningfully help break our addiction to fossil fuels in time to avert a climate crisis. In 2008, the International Energy Agency concluded a comprehensive review of second- and third-generation agrofuels by stating that:

"… full commercialization of either biochemical or thermo-chemical conversion routes for producing second-generation biofuels appears to remain some years away. … Even with generous government subsidies the commercial risks remain high, especially with recent widely fluctuating oil prices and global financial turmoil adding to the investment uncertainty. … Overall, unless there is a technical breakthrough in either the biochemical or thermo-chemical routes that will significantly lower the production costs and accelerate investment and deployment, it is expected that successful commercialization of second-generation biofuels will take another decade or so."[63]

Effects of Second-generation biofuels on land use and biodiversity

Little research has yet been conducted into the land-use implications of second-generation agrofuels. However, the common industry claim that second-generation agrofuel feedstocks such as jatropha and switchgrass would be grown on "idle" or "marginal" lands to avoid conflicts with food production sets off red flags. In many cases, these "marginal" lands are in fact being heavily used by local communities – as pasture land for common livestock, as subsistence farmland, or as sources of wood and other vital resources. This land is considered "marginal" largely because these communities' land rights are not codified and legally recognized; however, use of such lands follows rules and customs of common property that are vital to the communities that use these lands to sustain themselves. In the words of Genet Jarso, an Ethiopian representative to the U.N. High Commission on Human Rights:

"The pastoral groups of the region traditionally depend on the common property resources consisting of pasture, water and mineral licks. … Customarily, land is the collective property of the pastoralists and managed according to specific rules. … Pastoralists have always been left on the margin of development. The general public and the decision makers who come from the farming communities often misconceive their production system, particularly mobility and flexible land use systems. … [T]heir lands are often taken from them by the states or private schemes because the latter think that the land is empty. [This has] resulted in displacement of pastoral communities, leading to livelihood crises."[64]

In many places in the Global South – especially in Africa – land grabs under the first-generation agrofuels boom was often justified under the pretext that the land being used was "marginal." However, many of these land grants resulted in significant land rights abuses. In the case of a project by Sun Biofuels in Tanzania, the company stated that it had gained approval for its project from 10 of 11 communities in the area – when in fact several communities were not even aware of the company's plans. A Tanzanian village leader complained to the district administration that Sun Biofuels had cleared and marked off land without even contacting the village elders.[65]

Pieter de Pous, Agriculture Policy Officer for the European Environmental Bureau, points out the potential dangers of second-generation agrofuels for biodiversity:

"At first sight, [second-generation biofuels] do have a number of attractions: they can be used from the leftover products from agriculture and forestry or be specifically grown on non-productive land. Therefore no extra land needs to be converted in theory. The problem is that these 'waste' streams are part of a nutrient

> cycle and play a rather crucial role in the productivity of agricultural or forestry systems. Losing these nutrients to energy production would mean replacing them with mineral fertilizers and increasing diffuse pollution. In forestry the competition is even more pronounced: forest biodiversity is intrinsically linked to the presence of deadwood in the forest. Creating a sizeable industry that incentivizes forest owners to take out the dead 'leftover' wood and use it for fuel could greatly damage forest biodiversity. … But perhaps the greatest threat to biodiversity from second-generation biofuels derives from the mere suggestion to policy makers that the problems associated with first-generation can be avoided. Second-generation biofuels can only deliver limited volumes and certainly will not make it possible to meet the [E.U.'s] 10 percent target in a sustainable way."[66]

Thorough, independent research remains to be done on the land-use and sustainability implications of expanded second-generation agrofuels production; however, it is clear that second-generation agrofuels face substantial technical problems, and that their production on a large scale could well have highly negative effects on marginalized communities and biodiversity.

Rafaello Garofalo, Secretary General of the European Biodiesel Board, states that, "second-generation technologies are not a panacea. While they have great potential, some of the current technologies are as good – and in some cases even better."[67] This overlap of advocacy for first-generation and second-generation agrofuels extends to the policy sphere: for instance, when U.S. Energy Secretary Stephen Chu announced $786 million in funding for second-generation agrofuels research in May 2009, he simultaneously announced $1.1 billion in funding for first-generation biorefinery and agrofuels infrastructure build-out.[68] More generally, the Obama Administration has continued the Bush Administration's strong financial support for the ethanol industry, while simultaneously arguing that second-generation agrofuels need to be pursued and developed.

Following the Money

The agrofuels boom is being driven by three industries with well-documented histories of problematic social and environmental abuses: large agribusiness conglomerates, the biotech industry and most recently, the oil industry. This combination has started to be called the "agro-energy lobby," and is highly influential in advancing its interests and influencing public policy through lobbying, political connections and financial contributions.

Big Agribusiness

Agrofuels are actively being promoted as a climate solution by some of the largest multinational agribusiness corporations in the world, notably Cargill, Archer Daniels Midland, and Bunge. All three are based in the U.S., and all are heavily involved in agrofuels production.

Agribusiness is politically well connected and benefits from public subsidies to an extent rivaled by few other industries. Between 1995 and 2006, the U.S. government spent over $177 billion on agricultural subsidies.

In agrofuels, U.S. government friends of agribusiness have found a vehicle which they can exploit to continue pouring subsidies that benefit large corporate agricultural interests, while publicly portraying those subsidies as going towards carbon emissions reductions, energy independence and family farmers. In the past five years, agrofuels subsidies have exploded: in 2008, the U.S. spent $9.2 billion on agrofuels subsidies, and the E.U. spent $5.2 billion in 2007.[69,70]

The Biotech Industry

Two massive biotechnology corporations have become hugely involved in agrofuels production: Monsanto (based in the U.S.) and Syngenta (based in Switzerland). Monsanto and Syngenta have faced substantive public criticism in the past two decades – especially in Europe, but also in the U.S. – for their role in developing genetically modified crops. Agrofuels have played a major role in returning biotechnology companies such as Monsanto and Syngenta to profitability. Both companies have launched genetically modified crops designed specifically for agrofuels production. Perhaps the best example of this newfound collaboration is Renessen, a Monsanto-Cargill joint venture described by Annie Shattuck:

> "In an indication of what is to come, Monsanto and agribusiness giant Cargill have recently launched a joint venture called Renessen, a whole new corporation with an initial investment of $450 million. Renessen is the sole provider of the first commercially available GM dedicated energy crop, "Mavera High-Value Corn." Mavera corn is stacked with foreign genetic material coding for increased oil content and production of the amino acid lysine, along with Monsanto's standard Bt pesticide and its Roundup Ready gene. The genius of this operation, and the danger to farmers, is that farmers must sell their crop of Mavera corn to a Renessen-owned processing plant to recoup the "higher value" of the crop (for which they paid a premium on the seed). Cargill's agricultural processing division has created a plant that only processes their brand of corn. Further, due to the genetically engineered presence of lysine, an amino acid lacking in the standard feedlot diet, they can sell the waste stream as a high priced cattle feed. Renessen has achieved for Monsanto and Cargill nearly perfect vertical integration. Renessen sets the price of seed, Monsanto sells the chemical inputs, Renessen sets the price at which to buy back the finished crop, Renessen sells the fuel, and farmers are left to absorb the risk. This system robs small farmers of choices and market power, while ensuring maximum monopoly profits for Renessen/Monsanto/Cargill."[71]

Renessen is but one example of the ways in which the biotechnology corporations are profiting from the agrofuels boom – both directly through the use of GMOs in agrofuels production, and indirectly by helping them to "greenwash" their public images.

Big Oil

Publicly, the oil industry spent many years loudly denouncing the expansion in agrofuels production. However, the oil and agrofuels industries in the U.S. have begun to work much more closely together since 2008 – resulting in strategic alliances that may make the agrofuels industry more politically powerful.[72]

Under the 2005 Volumetric Ethanol Excise Tax Credit, gasoline refiners receive a tax credit of $0.51 per gallon of ethanol added to gasoline. Given that 9.5 billion gallons of ethanol were sold in the U.S. in 2008, that amounts to as much as $4.8 billion in agrofuels subsidies paid to oil companies.[73,74] In May 2009, the average U.S. retail price of a gallon of gasoline was $2.28, and the energy-differential-adjusted[75] price of a liter of E85 (85 percent gasoline blended with 15 percent ethanol) was $2.50.[76] The cost of 0.15 gallons of ethanol, enough to make a gallon of E85, was only $0.26 (and that price is made even lower by the ethanol tax credit, which knocks $0.08 off the price of that 0.15 gallons of ethanol).[77] Thus, there is a significant financial incentive for oil companies to add ethanol to their gasoline.

The public perception that agrofuels are a "low-carbon" fuel allows oil companies to market E85 as a lower-carbon product, and to portray themselves as environmentally responsible – an invaluable asset at a time when the American public is becoming increasingly concerned about climate change, and when oil companies are facing public outrage due to record profits and high gasoline prices. Thus, while publicly continuing to oppose increased ethanol mandates, the oil industry has been quietly investing in ethanol production:

- Valero bought seven ethanol refineries from bankrupt ethanol producer VeraSun for $477 million in March 2009, and had previously invested millions in algae-based ethanol startups Solix and ZeaChem.[78] [79] [80]

- ConocoPhillips and ADM announced a $10 million ethanol research partnership in October 2007.[81]

- In May 2008, Marathon completed an ethanol refinery in Ohio, built in partnership with The Andersons, a diversified agricultural producer.[82]

- Shell has invested over $50 million in Codexis, a cellulosic ethanol research company, in 2008-2009, and bought 50 percent of ethanol researcher Iogen in July 2008.[83] [84]

- BP invested $90 million in cellulosic ethanol researcher Verenium in August 2008.[85]

And the politically adroit Archer Daniels Midland is taking the lead in building connections with the oil industry: ADM's CEO Patricia Woertz was Chevron's Executive Vice President of Global Downstream Operations until she was hired by ADM in 2006, and Antonio Neto, a member of ADM's Board of Directors, is a former executive of Petrobras, South America's largest oil refiner.[86] As financial reporter Ángel González puts it:

> "During the early years of the boom in investment and interest in alternative fuels witnessed earlier in the decade, entrepreneurs were charting a course that would have led to a separate supply chain: dedicated ethanol collection hubs, pipelines and filling stations. No longer. With the alternative fuel movement running up against falling demand and government regulation of carbon dioxide emissions, executives have realized that the nascent industry must complement, not compete with fossil fuels to succeed."[87]

The agrofuels industry is rapidly becoming an integral part of the oil industry. As the head of BP's biofuels unit, Phil New, puts it: "If the government is going to make a market happen, we need to be able to participate commercially in that market."[88]

Greenwashing

This new agro-energy lobby has clearly formed a strategy to combat the more recent scientific findings that cast doubt on the environmental benefits of agrofuels; a defense that is strikingly similar to the argument that many corporations, industry groups, and government officials used for many years (and that some continue to use) to undermine greenhouse gas regulations in general.

Like global warming deniers who cast doubt on the clear scientific evidence of man-made climate change, the agro-energy lobby is promoting the argument that the science behind land-use change calculations is "insufficiently scientific," and that we should wait to include such calculations until "scientific consensus" develops.

For example, in comments made at the California Air Review Board's hearings for the Low Carbon Fuel Standard, numerous agribusiness and oil companies issued nearly identical statements in response to the CARB's inclusion of land-use change into their calculations:

- Shell Oil: "… there is a growing body of opinion and evidence that the methodologies for determining biofuel indirect land use change impacts are not yet sufficiently advanced."[89]
- Monsanto: "… methods to estimate indirect land use change are still at a very early development stage … and do not adequately address the complex issues underlying land use change."[90]
- The National Corn Growers' Association: "NCGA shares the consensus among the agriculture and ethanol industries as well as several in academia, that the modeling used by the ARB has not been sufficiently validated scientifically."[91]
- BP: "… the current [indirect land use change] mechanism… is not scientifically or methodologically robust."[92]
- The Biotechnology Industry Organization: "… at this time, [indirect land use change] calculations lack the requisite scientific rigor to support their incorporation into law."[93]

It is clear that these efforts to question the growing body of scientific evidence pointing away from the embrace of agrofuels as a substitute for fossil fuels are an attempt to protect the growing profits that the agro-energy lobby sees from a budding agrofuels industry.

Conclusions and Recommendations

As evidence mounts about the social and environmental consequences of agrofuels, it becomes clear that we cannot grow our way out of our oil addiction. Agrofuels will not solve the twin crises of climate change and over-dependence on oil. If we don't take action to rein in the rapid global expansion of agrofuels we will in fact be making these problems worse. Rather than continuing to pursue agrofuels policies and increasing the global market place for agrofuels, we call on decision makers in the corporate and political arenas to prioritize proven, true solutions that halt the expansion of carbon-intensive industries.

- For corporate and political decision makers, we recommend a precautionary approach to agrofuels, comprehensively implemented in all policies, regulations and contracts. The environmental and social costs of agrofuels currently on the market are too high, and do not offer a viable solution to twin crises of our addiction to oil and catastrophic climate change. Rather than policies that support agrofuels, we recommend policies that help to reduce our energy consumption, encourage and fund mass transit, pedestrian and bike transit, and support plug-in vehicles and a green grid powered by wind and solar energy.

- Second generation biofuels such as cellulosic ethanol or algae biodiesel carry their own social and environmental consequences. As second generation biofuels are not yet on the market, we recommend that today's decision makers learn from the EU's experience with palm oil biodiesel and adopt a precautionary approach while scientists work to determine the social and environmental costs.

- For policymakers on the local, regional or national levels considering biofuels policy, we recommend avoiding the negative consequences of agrofuels by requiring:

    - local production to reduce indirect land use and distribution emissions impacts
    - production, distribution, processing and refining emissions to be lower than the current fuel source
    - feedstocks to be sourced from waste such as vegetable grease and solid waste streams
    - zero contamination of air and water resources in all production, distribution, processing and refining.

- For corporate and political decision makers, financiers and investors interested in investing capital into alternatives to oil and reducing greenhouse gas emissions through investments in renewables and alternatives, we recommend supporting proven transportation alternatives such as mass transit, bicycle transit, plug in vehicles, and a green grid for both energy and transportation recharging.

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