

Agriculture and climate change: Real problems, false solutions

*Preliminary report by Grupo de Reflexion Rural, Biofuelwatch, EcoNexus
and NOAH - Friends of the Earth Denmark*

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This is a preliminary version of a new report on Agriculture and Climate Change.
prepared for the Bonn Climate Change Talks, June 2009

The complete draft is available online at
<http://www.econexus.info/pdf/agriculture-climate-change-june-2009.pdf>

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Executive Summary

Industrial agriculture clearly causes climate change. But can changes in agriculture also help to mitigate the problems of climate change? Would carbon credits for agriculture promote such changes?

This report gives a brief overview on how current and proposed agricultural practices impact on climate changes, and how proposed measures for 'mitigation and adaptation' impact on agriculture. It focuses on forms of intensive, large-scale (or industrialized) agriculture. It looks at the main proposals in the negotiations for a post -2012 climate agreement. In the context of these negotiations, mitigation describes measures that deal with the causes of climate change, while adaptation encompasses measures to deal with the effects of climate change.

Industrial agriculture as currently practiced with monocultures and agrochemicals in a globalized production system, is a major contributor to climate change, causing emissions of greenhouse gases (GHG) through changes in land use and soil losses/ degradation, through agricultural technologies and from livestock. At the same time, climate change is already serious and likely to get worse, resulting in land loss and unpredictable changes of natural growing conditions.

Agricultural emissions and carbon credits

Yet in many quarters, including the United Nations Framework Convention on Climate Change (UNFCCC) itself, further intensification of industrial agriculture is proposed as a solution to the problems of climate change to which it has

contributed in the first place, without the impact of agriculture on climate change being addressed. In the current negotiations for a new climate treaty that is supposed to follow the Kyoto Protocol in 2012, agricultural practices are proposed as a means for climate change mitigation and as part of carbon trading. A particular focus of discussion is the storage of CO₂ and other forms of carbon in the soil (soil carbon sequestration).

One question to address at the beginning is what **GHG emissions from agriculture** do we already have now? About 40% of the land is currently used as agricultural lands, i.e. cropland, managed grassland, permanent crops including agro-forestry. A third of the arable land is used for feed production. Over the last 40 years, 13 million hectare of land including 6 million ha forest land were converted to agriculture annually, leading to depletion of soil matter and GHG emissions from soils. At the same time the livestock industry for meat and dairy production emits methane and nitrous oxide.

Economic growth, industrialized farming systems, greater meat consumption, free trade policies, and biomass production have greatly contributed to this development. Future trends such as further intensified agriculture dependent on agrochemicals and irrigation, increased and intensified livestock production, increased production of agricultural products besides food and feed (biomass, agrofuels, bioplastics) to replace fossil fuel products will only increase this trend.

Free trade in agricultural products also plays a double role here because the import of animal feed and agricultural commodities allows the (richer) importing countries to understate their true emission figures since the emissions in the production country don't enter into the importing countries' calculations.

While CO₂ emissions *increased* ever since the Kyoto Protocol came into force in 2005, so has the trade in CO₂ equivalents emission reduction. In 2008, **carbon trading** increased by 83% in just one year to 4.9 million CO₂ equivalents (CO₂e), and the majority of proposals for a post 2012 climate change agreements aims at further increase, including through the heavily criticized Clean Development Mechanism (CDM).

Today agriculture - or rather agribusiness and plantation companies - benefits from about 10% of CDM credits, including livestock manure management, heat generation from palm oil and

using agricultural residues from biomass. However, credits for carbon sequestration in soils have so far not been accepted under the UNFCCC. In the case of no-till monoculture as a form of sequestration, there is evidence that it rather harms than benefits the climate and the soil still could be tilled at any moment, emitting carbon again. And for biochar, there is no consistent information of its fate in soils while any black carbon getting airborne from biochar practices would seriously contribute to climate change.

The questions put before the negotiators includes what kind of agriculture would be likely to be funded through carbon trading? Would this necessarily be a sustainable form of agriculture? The list currently proposed by the UNFCCC includes a number of questionable practices that are likely to intensify industrial agriculture, such as for example agrofuel production, supporting them as climate friendly despite overwhelming and peer-reviewed evidence that they *accelerate* global warming. Non-industrial, biodiverse farming by small-scale farmers however is unlikely to benefit. The aim of protecting forests through REDD is already seriously undermined by the fact that the UNFCCC definition of 'forests' includes industrial tree and shrub plantations.

Proposals for soil carbon sequestration: Non-tillage and biochar

In **non-tillage agriculture** (NT or no-till), soil carbon emissions are meant to be reduced by not disturbing the soil through tillage. There are different forms of this practice, but the dominant method is to sow (or drill) the seeds into the residues for the previous crop, and to deal with weeds through the application of herbicides. Even though genetically modified (GM) crops were not explicitly developed for this purpose, they lend themselves to this practice. To date there are only estimates of how much carbon is sequestered in the soil in NT systems, and how this interacts with other factors, like soil respiration, N₂O emissions and de-nitrification. At the same time, experiences from existing, large scale NT agriculture show negative impacts on the environment and the climate.

In 2009 in Argentina, nearly 17 million hectares are cultivated with GM soya under NT, representing 20% of the total NT acreage worldwide. After more than 10 years of this practice, problems include such a heavy compaction of the soil that it fails to absorb water, herbicide resistant weeds, high use of agrochemicals with associated environmental

problems, soil demineralisation and adverse effects on waters. It is still unclear to what degree the leaves left on the field at the end of the growing season contribute to nitrates in the soil, and how much phosphorus is effectively removed from the soil in form of the harvested soybeans.

Biochar is proposed as a new form of soil carbon sequestration in which fine-ground charcoal is applied to the soil. The type of carbon in this case is identical to 'black carbon', small particles known for its disastrous effects on climate change when airborne. The application of charcoal is known from some traditional agricultural practices where it has been part of biodiverse integrated farming methods, but the practices supported by the International Biochar Initiative (IBI) bear little resemblance to this. IBI argues that applying charcoal to soils would create a reliable and permanent carbon sink, and would mitigate climate change, as well as making soils more fertile and water retentive. However, even the studies of IBI members and supporters indicate high levels of uncertainty and counter-indications. In addition, proponents of biochar do not consider the direct and indirect impact of land-use changes required to grow enough biomass raw materials, or the impact of removing large quantities of so-called residues from fields and forests. Biochar advocates describe the burning of biomass to produce charcoal (pyrolysis) as (close to) carbon neutral because GHG emissions during combustion are supposedly offset by new growth. This completely overlooks the impacts associated with the conversion or degradation of large areas of land necessary in this process, and thereby the destruction of existing ecosystems. Yet biochar is explicitly proposed for negotiations.

It is also unclear how long most black carbon will remain in the soil, how fast much of it will be degraded and turned into CO₂, and to what extent it can cause pre-existing organic carbon in the soil to be degraded and emitted as CO₂. Recent research shows that adding charcoal to soil sometimes even *increased* soil respiration and thus CO₂ emissions.

In addition to these unanswered questions about the effectiveness of biochar as carbon sequestration and its possible effects on soil fertility and soil respiration, a real danger lies in the actual application procedure of biochar. Laying charcoal near the soil surface may lead to erosion, oxidation and air borne particles. Airborne black carbon has a global warming impact 500-800 times greater than that of CO₂ over a century. Tilling it into the soil on

the other hand can damage soil structures and cause break-down of pre-existing soil carbon.

Where should it all come from? GM crops and marginal lands

Proposals to use agricultural land for mitigation and adaptation, to produce biomass for biochar and agrofuels to replace fossil fuel production and to act as carbon sinks, have to deal with the problem that the industrial production plus food and feed already requires more agricultural land than available.

On the one hand, new **genetically modified (GM) crops** are proposed for higher yields through a number of new or enhanced traits (more yield; the ability to grow in different and/or hostile environments; changed composition to convert plants into raw materials more efficiently etc.). However, none of these crops, even if they could be developed, are likely to be available any time soon, and for a number of the promised GM traits, it becomes more and more questionable whether they can ever be achieved given the complexity of the genome and gene regulation. At the same time, despite adverse claims, the currently herbicide tolerant and insecticide producing GM crops, in general do not show yield increases. Especially the large-scale cultivation of herbicide tolerant GM crops (as for example described for Argentina) shows especially negative environmental and climatic impacts.

Climate change has intensified the need for abiotic stress tolerance in crops, but this does not mean we must develop stress tolerant GM crops. Abiotic stress tolerance can also be developed through conventional breeding or by using already adapted crop varieties.

Moreover, a focus of crop development on GM crops can cause high opportunity costs: money and time spent on technical developments for crops for the same agricultural model of intensive monocultures that are already now causing problems. GM crops are also fundamental to the development of the bioeconomy, whereby products from fossil oil deposits will be replaced by products derived from biomass. Growing the requisite amount of biomass has massive implications for land-use and climate change in future.

Besides increasing yields per hectare, another general proposal is to increase the acreage for agriculture by using so-called '**marginal**' lands. However, un-used land is rare. Instead much of it is common/communal land, collectively used by local people who might not have an individual land title,

but who used it as vital resources for water, (additional) food, medicines and materials, and/or extensive grazing ground for livestock. What's seen as marginal land is often land used by 'marginalized people, by economically weaker parts of the communities. Such land is also important for biodiversity, water supplies, soil and ecosystem regeneration.

The omitted part of agriculture: livestock industry and feed production

Proposals to reduce emissions from agriculture often focus on plant production or soils, while livestock production is often omitted in spite of the fact that it accounts for important amounts of CO₂, NO₂, CH₄ and NH₃ emissions. Factory farms cause unsolved problems of water, soil and air pollution. Significant parts of agricultural land are used for feed production.

Industrial livestock production has moved away from multifunctional animals fed on locally produced roughage and nutrient rich waste from farms and households to genetically uniform breeding lines selected for high output that need standardized food, intensive veterinary care and controlled environments to avoid any infection. 'Compound feed' now competes with food production and is transported over long distances, causing negative climate impacts.

A drastic reduction of meat and milk consumption would therefore have a significant positive climate impact. It would also have a positive health impact on the world population since one billion people are obese - about as many people as are under-nourished. A change towards integrated, multifunctional systems and extensive grazing on grasslands can contribute to positive impacts of agriculture. Grassland and ruminating animals have evolved together. Extensive grazing should be supported to maintain grasslands as a major carbon sinks and as ecosystems.

However current proposals aim for even more intensified livestock production with animals bred for higher rates of feed conversion, in order to lower GHG emissions per product unit. However, such calculations are not relevant unless the *whole* life cycle including feed production is taken into account. The same goes for aquaculture systems where, for example, effects like cross-breeding of escaped salmon with wild salmon or deforestation to establish shrimp farms are not taken into account.

Other programmes aim at reducing the amount of GHG emitted by ruminant animals, but since methanogenes, the organisms digesting roughage in the rumen, belong to the least understood group of microorganisms, any project to change the enteric fermentations of cattle is a long way off.

Conclusions

Agriculture plays an important role in climate change, both as a contributor emitting GHGs and as a potential reducer of negative impacts. However, the current range of proposed technical solutions such as biochar, no-till agriculture with herbicide tolerant GM crops, the replacement of fossil energy products with agricultural (raw) products, the potential development of GM crops with completely new traits, and the wide spread use of industrial biomass processing biorefineries, as well as the increasing inclusion of these and more into carbon markets are a diversion from what is really required. In most cases the effectiveness and the possible negative impacts of the proposed measures are not yet assessed, and the plants are in the early stages of development. In general there simply is not enough land to account for the proposed projects, and the danger is that the option to gain carbon credits will put even more pressure on small-holders and marginalized people, living off so-called marginal land. The proposals, far from mitigating climate change, can be expected to seriously worsen it, and to also have a devastating impact on biodiversity.

But there are options for using agriculture to mitigate climate change: reversing intensive forms of agriculture, reducing reliance on agrochemicals and drastically reducing meat consumption. The challenge for a post-2012 climate treaty however is to withstand the lobbying of companies wanting to profit and take carbon credits from agricultural practices, and to properly stimulate change toward a sustainable and climate-friendly agriculture.

complete report:

<http://www.econexus.info/pdf/agriculture-climate-change-june-2009.pdf>