Biofuelwatch response to Climate Change Bill consultation.

Biofuelwatch campaign against the use of bioenergy from unsustainable sources, i.e. biofuels linked to accelerated climate change, deforestation, bio-diversity losses, human rights abuses, including the impoverishment and dispossession of local populations, water and soil degradation, loss of food sovereignty and food security. Biofuelwatch are also campaigning for a moratorium on agrofuels from large-scale monocultures as an immediate step to stop further large-scale investment into agrofuel and related infrastructure projects linked to the destruction of ecosystems and carbon sinks and the loss of farmland on which communities rely for their food sovereignty and food security. This includes a moratorium on targets, subsidies and other incentives. In the UK, this means and an immediate suspension of the RTFO and in Europe of the targets, obligations and incentives arising from the EU Biofuel Directive. Internationally, we support a moratorium on funding for agrofuels from large-scale monocultures, including through carbon market mechanisms, such as the Clean Development Mechanism or Joint Implementation under UNFCCC;

Biofuelwatch is calling for a moratorium on research and development into biomass-to-liquids agrofuels, namely cellulosic ethanol, which carries high environmental risks due to the GM technology involved and, if successful, the potential for increased exploitation of the biosphere.

Commentson Climate Change Bill below;
Included; Background paper on impact of biofuels on climate change, which forms part of our submission.

General:

- The emissions reduction target does not reflect the prevailing science on climate change i.e. the cut required to avoid dangerous climate change.
- Aviation and shipping are not included.
- There is no mention of Contraction and Convergence (as proposed by GCI) even though the Royal Commission on Environmental Pollution 2000 report is explicitly based on C&C. Leadership by the UK on the International stage demands adoption of C&C.
- There are no annual binding targets.
- There is no mention of carbon sink protection and policies regarding their drivers, when this is essential to preventing dangerous climate change. The RTFO in particular is recognised as a driver of carbon sink (ecosystem) destruction.
- The emission reduction pathway is linear when it needs to be front-end loaded.
- The trade off between climate change mitigation and economic growth has serious implications from the positions of climate stabilization and leadership.
- Policy should relate to a ‘low’ carbon economy not a ‘lower’ carbon economy.
- The only policies and mechanism for reducing emissions appears to be the EU ETS, CDM and the RTFO. This reliance is very worrying and more detail is given in our response. The CDM and RTFO are both causing irreversible damage to ecosystems…and increasing emissions in the process.
- It is of deep concern and surprising that the Bill suggests in theory all UK emissions could take place overseas. This oxymoron is also an abdication of our responsibilities.

- There is no mention of peak oil, which could well be a driver of carbon sink destruction as the world looks for alternatives to fossil fuel. Biomass-to-liquid technologies in particular would allow conversion of virtually any vegetation into liquid fuel with disastrous consequences for the climate.

Comments relate to specific parts of the Bill; the original is 'cut and pasted' in black, our comments are in blue:

2.6 The Stern Review recently stated that without intervention greenhouse gas levels will reach no less than 550ppm CO_2e by the middle of this century[6]. This level alone would commit the world to a warming of at least around 2˚C above pre-industrial levels in the long term, with some recent studies suggesting up to a 20% probability that the warming could be greater than 5°C. A climatic change of this magnitude would be far outside the experience of human
civilisation and comparable to the difference between temperatures during the
last ice age and today.
The Draft Climate Change Bill aims to limit greenhouse gas levels to 550 ppm CO2e by the middle of this century despite the quoted evidence that this is completely insufficient. 5C was last experienced 55 million years ago at the Eocene epoch, which would make our world virtually uninhabitable for humankind.

2.7 The IPCC report estimates that without intervention greenhouse gas levels will rise to 600-1550 ppm CO_2e by 2100, depending on future emissions. This
would be associated with a warming of between around 1.7 and 7.0 C above
pre-industrial levels (or 1.1 to 6.4 C above 1990 levels) by the end of the
century, and a further few degrees warming in the following century. In effect 251 million years ago at the end of the Permian period the temperature of the globe warmed by 6ºC. 95% of life on earth was wiped out. By committing us to at least 2C the Bill also commits us to a 20% probability of 5C warming!

3.8 They also decided to: increase the use of renewable energy sources so that they make up 20% of EU energy consumption by 2020, with differentiated overall targets for Member States; ensure that a minimum of 10% of EU transport petrol and diesel consumption comes from bio-fuels by 2020; The only specific 'renewable' energy to have these targets was biofuels. The target is currently 5.75% by 2010, which is set to rise to 10% by 2020. In the UK we are currently only at 0.6%. And as the government was aware when they introduced the RTFO and as was stated in the recent RTFO public consultation, most of this demand is being met by Southern nations using fragile peatland and tropical forests. Where it is met in part by European nations agriculture and in particular animal feed is displaced to the South.

At the 26th UNFCCC meeting in Bonn in May 2007, the working group III of the Intergovernmental Panel on Climate Change (IPCC) highlighted that such peatland degradation is an even more significant contribution to climate change emissions than deforestation. In short, **Peat destruction is a time-bomb that, unless stopped, will cause catastrophic climate change**
Millions of hectares of South-east Asia's peatlands are being drained for oil palm plantations. Those peatlands are one of the world's most important carbon sinks – they store 40-50 billion tonnes of carbon, which is the equivalent of about six years of global fossil fuel emissions. A recent study by Wetlands International, Delft Hydraulics and Alterra suggests that the

destruction of those peatlands is responsible for at least 8% of all global carbon dioxide emissions[41] – and this figure does not include the large-scale emissions linked to deforestation for palm oil. The UK Government support for the EU Biofuels directive is directly driving this destruction and climate change time-bomb.

Domestic Commitments

3.11 Domestically, the UK has already put in place a wide range of measures to reduce its CO_2 and other greenhouse gas (GHG) emissions, and is considering the introduction of others, as set out in the Climate Change Programme Review[10] and Energy Review[11].

There is no specific mention of the RTFO which the government describes as the main way to reduce emissions in the transport sector because it has described as 'politically difficult' enforcing the 70 mph speed limit. It is stated that the RTFO will remove the equivalent of 1 million cars off the road (if the greenhouse gas lifecycle calculations were correct, **which they are not**) and enforcement of speed limit, 890,000 cars. The same government report states that if speed limits were changed then 1.7 million cars would be taken off the roads in terms of CO_2.

3.13 The Government would therefore like to enshrine the commitments in the Energy White Paper 2003[14] to reduce CO_2 emissions by 60% on 1990 levels by 2050; In 2003 an Environment Department report said that 550 ppm CO_2 – ie the Climate Change Bill target – would lead to global temperature rise of 2 to 5ºC this century. In 2006 a government report said that the figure should be 450ppm or lower. This target figure equates to 666 ppm CO_2e which the Stern Review stated (for 650 ppm CO_2e) gives a 60-95% chance of reaching 3ºC. The Tyndall Centre said the bill would give an 80% chance of exceeding 2º; 60% chance of 3º and a likelihood of 4-5ºC. And to achieve "real progress" by 2020 (which would equate to reductions of 26-32%) (In other words a further 6-12% in 10 years which takes us 5 years beyond the date 'Avoiding Dangerous Climate Change'.

3.15 The UK is currently responsible for 2% of global GHG emissions and therefore is clearly unable to address the global problem of climate change alone. However, this point should not be used as an excuse for not taking further action. The major developed economies are responsible, collectively, for approximately three quarters of the increase in GHG concentrations above preindustrial levels.

2% does this include aviation & shipping. It does not include the embedded carbon of imported goods which adds a further 1.5% according to the SDC. It ignores the 15% UK contribution to total historic emissions. The UK RTFO which is a driver of deforestation in the tropics, significantly contributes to emissions in the South and is not accounted for.

4.5 The Bill will create such a framework, to enable the UK to meet domestic targets as well as ensuring the UK can meet its existing and future international commitments.

Targets used are insufficient to meet commitments to stabilising GHGs. The mechanism needs to be based on science and equity; C&C. In 2000 the Royal Commission on Environmental Pollution came up with the bills target of 60% by 2050. This was based on a nominal C&C stabilisation of 550 ppm (although they later talked about between 400-450 ppm. In 2003 the government accepted the principle of C&C. So why has it not been mentioned once in this document and why is the figure 7 years out of date?

5.9 We are focusing our emissions reduction goals on carbon dioxide as we have made less progress in reducing this gas than other greenhouse gases. CO_2
Figures needed otherwise insufficient justification for ignoring other major contributors to climate change.

5.10 Climate change mitigation will not be possible without specific actions focused on reducing CO_2 emissions. This means moving to lower carbon technologies across the economy. It is intended that this Bill relates to CO_2 rather than other GHGs in order that this focus is maximised.
'Maximisation' would be achieved by getting the double win of combining other gases. E.g. Restrictions on coal burning reduce both CO2 and soot emissions.

5.12 Further non-CO_2 emissions reductions can be very difficult and/or costly, for example as concluded in a recent study on non-CO_2 emissions reductions from certain activities[24]. Cost should not be a reason for not taking action. Methane is a greenhouse gas 23 times more powerful than CO2. Nitrous oxide is 296 times and HFC-23 is 11,700 times more powerful than CO2. The financial cost to civil society of not mitigating climate change will be beyond all human experience.

(pg 24) Box 2: Tackling Non-CO_2 Emissions
As expressed in the Climate Change Programme Review 2006, the Government is committed to "*examining the scope and feasibility of a market based mechanism to facilitate trading of greenhouse gas (GHG) reductions from agriculture, forestry and other land management sectors".* All market based solutions lead to corporations making money and reductions not being made. All market based solutions to preventing deforestation have failed in the absence of further regulation or have only been deemed successful when displacement to other regions has not been accounted for. The drivers of deforestation must be stopped and the land rights of indigenous and local peoples who have the greatest likelihood of safeguarding forests must be strengthened.

(pg 25) **Question 1**: Is the Government right to set unilaterally a long-term legal target for reducing CO_2 emissions (yes!) through domestic and international action by 60% by 2050 and a further interim legal target for 2020 of 26-32%?
No. It needs to be at least 90% by 2030 and must include aviation and shipping as part of a C&C mechanism plus the protection of carbon sinks.

Question 2: Is the Government right to keep under review the question of moving to a broader system of greenhouse gas targets and budgets, and to maintain the focus at this stage on CO_2?
Rather a vague question. The Government should immediately review the question of moving to a broader system of greenhouse gas targets and budgets.

Question 5: Do you agree there should be a power to review targets through secondary legislation, to ensure there is sufficient flexibility in the system? Yes.

Question 6: Are there any factors in addition to, or instead of, those already set out that should enable a review of targets and budgets? Prevailing science which takes into account the full range of climate feedbacks is the only factor.

Counting overseas credits towards the budgets and targets
5.26 A strong message from last year's Stern Review is that co-ordinated multilateral action is important and the cost of emissions reductions can be substantially reduced by allowing trading of emissions reductions as the means to utilise least cost abatement opportunities without environmental costs. This is the principle behind the various flexible mechanisms found in the Kyoto Protocol, as described in Box 4.

You say 'substantially' and yet the CDM has only issued 50 million tonnes of CER, which is the same as the UK produces in a single month.

The CDM/CER is deeply flawed. According to the Guardian, 53% of CERS are to burn HFC-23. It is cheap for the companies in question to install an incinerator and very lucrative, so much so that companies are expanding so as to be able to produce more HFC-23, making more money from more carbon credits.

CDM also funds carbon sequestration by planting mono-culture agri-forest. Such plantations are biologically inert, cause displacement of indigenous peoples and add to emissions by land clearance. In South America, tribes call them the "Devil's Orchards". Some plantations have replaced rainforests with massive CO2 emissions and acceleration of feedbacks causing forest dieback elsewhere. 90% of CDM projects in Malaysia & Indonesia are for palm oil.

(pg 41) 5.68 There are a number of domestic trading schemes already in place across the UK economy, as shown in Box 7.
The **Renewable Transport Fuel Obligation (RTFO)** is due to be introduced into the transport sector in 2008. It will be similar to the Renewables Obligation. The RTFO will require the road transport and fuel suppliers to ensure that a proportion of their road fuel sales are from a renewable source, like bio fuels.

It is surprising and mis-leading to describe biofuels as a renewable resource when they accelerate climate change by ecosystem destruction, loss of sink capacity and acceleration of climate feedbacks.

Background Information for our submission:
Biofuels threaten to accelerate global warming

Report by Biofuelwatch, www.biofuelwatch.org.uk , April 2007

Background: Contribution of agriculture and land-use change to anthropogenic climate change

This report looks at the impact which large-scale biofuel production is likely to have on the global climate. It discusses the different sources of greenhouse gas emissions linked to the cultivation and refining of biofuel feedstocks as well as the impact on overall fossil fuel consumption. Particular emphasis is put on the direct and secondary impacts of biofuel expansion on the world's terrestrial carbon sinks, particularly those in the tropics and subtropics. Crops grown for biofuels can lead to the destruction of carbon sinks such as rainforests either because forests are directly converted to ‘energy crops’, or because other types of agricultural activities are displaced and pushed into forests and other important ecosystems.

Global warming is caused by human emissions of greenhouse gases, the three most important ones being carbon dioxide, methane and nitrous oxide. Fossil fuel burning accounts for most of those emissions, however, agriculture and deforestation together account for at least one third, according to the recent Stern Review[1]. The figures given for non-CO2 greenhouse gas emissions from agriculture and for deforestation are 14% and 18% respectively.

The Stern Review stresses that total emissions from land use will be greater, because there is no global estimate for soil carbon emissions as a result of agriculture and land-use change. Furthermore, neither the Stern Review, nor any of the IPCC Assessment Reports published to date, estimates global emissions from peat oxidation and fires. We will look at the information about different types and sources of greenhouse gas emissions linked to agriculture and land-use change, and the impact of large-scale biofuel expansion below.

Large-scale biofuel expansion could reduce fossil fuel emissions by a small proportion, though any such gains will be more than wiped out if the global transport sector continues to grow at present and forecast rates. The International Energy Authority states that, at present, biofuels account for 1% of global transport fuel. They forecast that they could account for 8% by 2030, but that, even so, the use of fossil fuel oil in global transport will still increase in absolute terms[2] , because of overall growth in transport fuel use. As long as energy use keeps rising, biofuels will not even be able to reduce fossil fuel use in absolute terms. Those IEA figures, however, refer only to the replacement of mineral petrol and diesel. They do not account for the fossil fuel use linked to biofuel production, i.e. the fossil fuels used in agricultural machinery and equipment, the manufacture of fertilizers, production of pesticides, transport, and during the distillery and refinery process. A 2006 review of life-cycle energy and greenhouse gas assessments[38] found that 74-95% of the energy in corn ethanol comes from fossil fuel inputs, and even that study has been criticized as over-optimistic by Tadeus Patzek[39]. Even those marginal fossil fuel savings can result in greater carbon emissions, as many refineries now rely on coal rather than gas or oil for energy. Coal has the highest carbon content (25.4 tonnes of carbon per terajoule compared to 19.9 tonnes per TJ for mineral oil). Fossil fuel use varies between different feedstocks – it is almost certainly highest for corn ethanol and substantially lower for sugar cane ethanol and palm oil biodiesel.

Our concern is that this small reduction in greenhouse gas emissions fossil fuel use due to biofuel expansion will be at the expense of large increases in greenhouse gas emissions from deforestation, from other land-use change, nitrous oxide emissions, carbon emissions from the loss of soil organic carbon, peat fires and oxidation, and potentially the loss of major carbon sinks. Our ability to stabilize greenhouse gas concentrations in the atmosphere and avoid the worst impacts of global warming depends on the ability of our ecosystems to continue functioning as carbon sinks, i.e. to continue absorbing large quantities of carbon from the atmosphere, including a considerable proportion of anthropogenic emissions. If ecosystems are destroyed or degraded so that they can no longer function as carbon sinks, then we will lose our ability to stabilise the climate.

Carbon Storage in the Terrestrial Biosphere		
Soil and Vegetation	**WBGU**	**ICBP**
Tropical Forests	428 Gt	553 Gt
Temperate Forests	159 Gt	292 Gt
Boreal Forests	559 Gt	395 Gt
Tropical Grasslands	330 Gt	326 Gt
Temperate Grasslands	304 Gt	199 Gt
Deserts/Semi-Deserts	199 Gt	169 Gt
Tundra	127 Gt	117 Gt
Croplands	128 Gt	169 Gt
Wetlands	225 Gt	n/a

WBGU (1988): forest data from Dixon *et al.* (1994); other data from Atjay et al. (1979)
IGBP-DIS (International Geosphere-Biosphere Programme – Data Information Service) soil carbon layer (Carter and Scholes, 2000) overlaid with De Fries *et al.* (1999) current vegetation map to give average ecosystem soil carbon.
From: IPCC Third Assessment Report: http://www.grida.no/climate/ipcc_tar/wg1/099.htm

We are particularly concerned because there is strong evidence that the results of deforestation and ecosystem degradation can be non-linear, i.e. that both agricultural intensification (based on large-scale monocultures and high fertiliser and pesticide inputs) and expansion could trigger large-scale, irreversible ecosystem changes and possible collapse which could then trigger equally irreversible climate feedbacks. This is dealt with in detail below. We are very concerned that there has been virtually no research into whether large-scale biofuel expansion might bring about 'low-probability, high impact' results – such as tipping all or part of the Amazon forest into an irreversible cycle of megafires and desertification, and if so, whether this is a high or a low probability. The evidence that biofuels mitigate climate change is scarce and controversial, particularly when we look beyond the micro-level (see our discussion of life-cycle greenhouse gas assessments below). On the contrary there is growing evidence that a shift to biofuels could greatly accelerate global warming.

Nitrous oxide emissions from agriculture

Nitrous oxide (N2O) is the third most important greenhouse gas responsible for anthropogenic global warming. Its global warming potential is around 296 times as great as that of carbon dioxide, and it has a long atmospheric life-time, of around 120 years. Atmospheric concentrations of N2O have increased by 17% since the industrial revolution. According to a 2006 report by the United States Environmental Protection Agency[3], annual global anthropogenic emissions of N2O are the equivalent of 3.114 billion tonnes of carbon dioxide emissions (which is equivalent to 849.55 million tonnes of carbon). Out of this total, agricultural nitrous oxide emissions account for the equivalent of 2.616 billion tonnes of carbon dioxide.

According to the Stern Review, total agricultural emissions (not including deforestation) increased by 10% in the 1990s and are expected to increase by a further 30% between now and 2020 – not taking account of an increase in biofuel production. Most of this increase is due to the greater use of fertilizers, particularly in the tropics, i.e. to practices mainly associated with intensive monoculture production. In Asia alone, nitrous oxide emissions have grown by 250%[4]. Adding the same amount of fertilizer to a hectare of tropical soils is linked to 10-100 times the amount of N2O emissions as doing the same in temperate soils.[5] Increasing intensive monoculture production, even without deforestation, will push those emissions up yet higher, particularly if it happens in the tropics. Yet it is widely expected that intensive monocultures will provide the bulk of the growing biofuel production globally. The United Nations Food and Agriculture Organisation has clearly stated that rising crop yields are linked directly to both irrigation and greater fertilizer use[6]. Indeed, all the optimistic scenarios for increasing global biomass production for bioenergy hinge on a rise in yields, which inevitably means higher N2O emissions. Apart from fertiliser use, conversion of forests to cropland, large-scale planting of legumes (such as soybean), and decomposition of organic residue have been identified as important sources of agricultural N2O emissions[7]. Rising N2O emissions from agriculture due to the planned expansion of biofuel production have not been factored into any emissions scenarios, but are clearly likely to be of global significance.

Biodiversity and secondary climate impacts from increased use of nitrate fertilizers

The full consequences of increased nitrate fertilization are not yet known. Humans have doubled the amount of biologically available nitrogen worldwide, and there is growing evidence that this is having disastrous impacts on biodiversity: Terrestrial ecosystems suffer as rain carries nitrogen-compounds over large areas and adding more nitrogen to soils leads to declines in plant species adapted to low-nitrogen environments. Freshwater ecosystems suffer from eutrophication, and UNEP have warned that hypoxic 'dead zones' in oceans are increasing rapidly in size and number and are to a large extent linked to agricultural nitrate run-offs and the use of nitrate fertilizers.[8]

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.[9] 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." Also, whilst soil nitrous oxide emissions linked to fertilizer input can be measured, less is known about similar soil emissions over larger areas fertilized not directly but indirectly, through rainfall.

Optimistic scenarios for global bioenergy production rely on agricultural intensification based on fossil fuel based external inputs.[10] We fear that the consequences for the global nitrogen cycle could have major impacts both on biodiversity and on the global climate. Many of these impacts are not yet fully understood. What is known, however, is that large-scale biofuels will increase the amount of nitrogen available to the biosphere. This will have serious consequences for biodiversity, for global nitrous oxide emissions and, increase carbon dioxide emissions from peat bogs[9]. Nobody can predict the full scale of those impacts, but enough is known to merit extreme caution about adopting large-scale monocultures for biofuels as a way of mitigating climate change.

Soil carbon emissions from agriculture

No global estimate for annual soil carbon emissions exists, however, the Intergovernmental Panel on Climate Change estimate that soil carbon emissions have historically accounted for 55 billion tonnes of carbon. Soil carbon emissions vary according to soil type, climate and agricultural methods. 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 far higher on peaty soils.[11]

A 2006 Wells-to-Wheels study by the Joint Research Council of the European Union, together with EUCAR and CONCAWE[12] states: "We already warned that increase of arable area would cause loss of soil organic carbon from grassland or forest: we assume it will not be allowed." The United Nations Food and Agriculture Organisation (FAO), however, say that biofuel expansion may well lead to crop expansion, particularly in North America and Western Europe.[13]

Some current claims being made about a large potential for biofuel crops worldwide actually involve large-scale ploughing up of pasture land, For example the 2006 'Quickscan of global bio-energy potentials to 2050' study[14] says: "A key factor was the area of land suitable for crop production, but that is presently used for permanent grazing." As the Well-to-Wheels study, warns, ploughing up of longstanding pasture can result in a large carbon emissions.

Although no-till agriculture has been suggested as a way of increasing soil organic carbon content on land, a recent study of no-till soya, corn and wheat production in the Argentina's Pampa shows that the additional nitrous oxide emissions linked to this cultivation method could outweigh any benefits in terms of soil organic carbon storage and lead to overall increased greenhouse gas emissions[15]. The same study also found that benefits in terms of soil organic carbon storage were considerably smaller than suggested by the IPCC. This study is very relevant in this context, because most of the soya grown in Argentina, Brazil, Chile and other countries is cultivated with non-till methods, and large-scale soya expansion for biofuels is expected and, in some countries, like Argentina and Paraguay, has already begun.

No-till methods are linked to greater use of nitrate fertilisers for grain production (including maize, which is increasingly used for bioethanol), and to greater water retention and to greater soil compaction and soil water retention which also increase nitrous oxide emissions, including from soybean monocultures. Furthermore, several studies link soybean monocultures to high N2O emissions, even if little or no nitrate fertilisers are used. This may be because of the high rate of biological nitrate fixation in legumes[16].

Finally, using land for biofuel production should be compared with the alternative, which is allowing natural vegetation to regenerate. Professor Renton Righelato, microbiologist and consultant on food chain issues to the European Commission, suggests that taking plantation land in Brazil out of production and allowing for natural forest regeneration (where possible), would sequester 20 tonnes of carbon dioxide per hectare over the next 50-100 years[17]. A study by Macedo et al[18], which does not take account of emissions from land use change, finds that CO2 savings compared to equivalent petrol use are 13 tonnes per hectare. This means that, even where no land-use change is involved, soil carbon sequestration from allowing natural vegetation to re-grow would be almost twice as effective for climate change mitigation than using the land for sugar cane ethanol production.

Carbon emissions from peat degradation

Around 550 billion tonnes of carbon - 30% of all terrestrial carbon – are stored in global peatlands[19]. Draining the peat leads of oxidation, whereby the carbon in the peat, which was previous water-logged and thus not exposed to the atmosphere, reacts with oxygen in the air to form atmospheric carbon dioxide. Drained peat is often susceptible to fires, which can greatly speed up those carbon emissions, as is happening annually on Borneo and Sumatra. Peat cutting, drainage and 'conversion' is a problem all over the world, 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 in the world. Palm oil expansion is particularly rapid in the peatland areas of both Indonesia and Malaysia, and scientists expect that nearly all of the peat will be drained, mostly for plantations, in coming years or decades. This will eventually lead to the emission of virtually all the carbon held in South-east Asia's peat – 42-50 billion tonnes, which is the equivalent of around six years of global fossil fuel emissions. The Indonesian government is planning a 43-fold increase in palm oil production, largely in response to the growing global demand for biofuels, with around 20 million hectares more land to be converted to oil palm plantations, as well as further concessions for sugar cane and jatropha for biofuels.
A recent study by Wetlands International, Delft Hydraulics and Alterra[21] estimates that one tonne of biodiesel made from palm oil from South-east Asia's peatlands is linked to the emission of 10-30 tonnes of carbon dioxide. Once emissions from peat fires and the loss of carbon sink capacity are taken into account, we estimate that one tonne of palm oil biodiesel from South-east Asia would therefore have 2-8 times more life-cycle carbon emissions than the amount of mineral diesel it replaces.

South-east Asia's peatlands are one of the largest single carbon sinks worldwide, and their destruction is one of the largest single sources of carbon emissions worldwide – with the emission of up to 2.57 billion tonnes of carbon having been released in the worst fire season so far (1997/98)[22].

The planned expansion of biofuel production from South-east Asian peatlands is widely expected to result in the destruction of this large carbon sink. The accumulated evidence from South-east Asia, where palm oil production has been undertaken for some time, illustrates that biofuel expansion can significantly accelerate GHG emissions and exacerbate global warming.

Biofuels, deforestation and global warming

FAO figures confirm that agricultural expansion is happening at the expense of natural habitats such as forests, particularly in Latin America, sub-Saharan Africa and south-East Asia[23]. Monoculture expansion, much of it for soya, palm oil and sugar cane, is currently accelerating at the expense of forests and other vital ecosystems. Further monoculture expansion in the global South would speed up deforestation and ecosystem destruction - as well as the destruction of biodiverse traditional farming systems, on which millions of people rely for their livelihoods and food security.

In September 2006, NASA published a study which showed that the rate of Amazon deforestation correlates with the price of soya[24]. Biofuel expansion is likely to push up the price of soya, both by creating additional demand for soya biodiesel and by US farmers switching from soya production to corn for ethanol. The Amazon forest holds an estimate 100-120 billion tonnes of carbon, equivalent to 13-15 years of global fossil fuel emissions, and if it was destroyed or died back, it would dramatically increase global warming. There is strong evidence that old growth forests sequester significant amounts of carbon from the atmosphere[25]. Our ability to stabilize greenhouse gas concentrations in the atmosphere depends on ecosystems remaining capable of sequestering carbon: If ecosystems collapse or are destroyed on a large scale, then there would be no way of stopping greenhouse warming from running out of our control. In this context, recent evidence about the vulnerability of the Amazon forest, and its crucial role in regulating rainfall patterns over large parts of the Northern Hemisphere, is particularly worrying. The Amazon forest 'recycles' 50-80% of its annual rainfall via evapo-transpiration, i.e. it sustains its own hydrological cycle. Deforestation, and in particular conversion to cropland, are proven to have a significant regional warming and drying effect, worse even than conversion to pasture[26]. The Woods Hole Research Institute has been at the forefront of studying the Amazon carbon cycle, hydrological cycle, and vulnerability to logging and climate change:

"The risk of fire and drought is enhanced by logging, which opens the forests, and by farmers and ranchers who use fire to replace rainforests with crops and pastures. A brutal downward spiral of drought, forest fire, and further drought could expand across much of the Amazon, replacing the species-rich rainforest with savanna like vegetation."[27]

Feedback mechanisms have already been demonstrated by NASA: Aerosols from forest fires suppress precipitation completely from some clouds, causing further drought and larger fires. Several studies suggest that the ratio between evapo-transpiration and rainfall is key to determining tropical vegetation, and that "vegetation change can be unannounced, catastrophic and persistent", with the possibility of large parts of the Amazon rapidly drying up, burning, and turning into savannah.[28]

Not all the processes are fully understood, hence it is impossible to say how close the Amazon is to a threshold beyond which large-scale die-back becomes inevitable, or how vulnerable different parts of the Amazon forest are. It is particularly concerning that extreme drought conditions were reported in large parts of the Amazon rainforest in both 2005 and 2006. 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." [29]

There is evidence that Amazon deforestation causes drying over a large region, as far as northern Mexico and Texas, and a forest die-back, it is widely feared, could devastate agriculture over much of Latin America and the southern US. Deforestation in Central Africa, on the other hand, has been linked to reduced rainfall in much of the US Midwest, whilst forest loss in South-east Asia appears to alter rainfall in China and the Balkan peninsula[30], with drastic consequences for agriculture over very large areas.

We have focused on the Amazon forest, because of the strong evidence that further conversion to cropland risks triggering disastrous and irreversible climate feedback mechanisms. 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. Soya expansion is linked to deforestation in the Pantanal, South America's Atlantic Forest and a portion of the Paranaense forest in Paraguay and North of Argentina. In Argentina, more than 500 thousand hectares of forest land were converted to soya plantations between 1998 to 2002[31]. Sugar cane expansion is impacting on many forests, including the Amazon, the Pantanal, South America's Atlantic Forest, rainforests in Uganda, and in the Philippines. Palm oil is linked to large-scale deforestation in South-east Asia, Colombia, Ecuador, Brazil, Central America, Uganda, Cameroon and elsewhere.

The above-soil carbon held in a mature oil palm plantation is only a small fraction of what old growth forests store: Primary forests in Indonesia have been found to hold 306 tonnes of carbon per hectare, whereas mature oil palm plantations hold 63 tonnes per hectare, but are not expected to survive more than 25 years at the most.[32]

We believe that, as long as there are no proven safeguards that biofuel expansion will not trigger further deforestation or ecosystem destruction, the risks involved are far too high. Small-scale 'greenhouse gas savings' which can be measured in micro-studies do not outweigh the very real risk of triggering catastrophic forest die-back in the Amazon and elsewhere, which could cause massive carbon releases, trigger other irreversible climate feedbacks, and potentially disrupt rainfall patterns and thus agriculture over very large areas.

Predictions for Biofuel Supplies and Climate Change

We are concerned that many of the studies which suggest that biofuel production can be increased significantly, particularly in Latin America, Asia, and Africa, without impacting on ecosystems or food supplies take no account of climate change projections.[33] Those studies project current climate conditions and crop trends for the past twenty years, well into the middle of this century. We believe that policy decisions should take into account of IPCC climate change predictions and must not be based on studies which fail to take these into account.

The 2007 IPCC Summary for Policymakers[34] predicts significant drying over large parts of northern and southern Africa, most of Brazil and parts of neighbouring countries, Chile and Argentina, Central America, large parts of Australia, the Middle East, Europe and Central Asia, with seasonal drying over much of South and South-east Asia. Together with temperature rises, those drying trends will inevitably reduce agricultural production in the very countries where monoculture expansion for biofuels is being promoted most strongly. Recent results from a climate modeling study for Brazil suggest that climate change will make cultivation of soya, corn and coffee impossible in large parts of Brazil, particularly in the north[35]. Predictions made for continuing yield increases in those countries clearly conflict with the results of climate change models.

In Europe, per hectare yields of oilseed rape have been falling for three years running because of 'extreme weather impacts'[36]. Climate change is expected to intensify those extreme weather trends. Falling per hectare yields will either lead to the expansion of cropland into land under natural vegetation, or to reduced output, or both.

Life-cycle greenhouse gas assessments: What can they tell us?

Much of the 'evidence' presented for biofuels reducing greenhouse gas emissions is based on life-cycle greenhouse gas assessments, which look at emissions linked to biofuel production within very close parameters, generally ignoring the larger picture of 'land use change', and often ignoring soil organic carbon emissions and, in some cases, nitrous oxide emissions. Only a limited number of life-cycle assessments have been peer-reviewed, and there is a complete lack of peer-reviewed evidence for some feedstocks such as palm oil or jatropha.

Many life-cycle assessments point to significant uncertainties, particularly with regard to the attribution of by-products, and soil nitrous oxide emissions[37]. Corn ethanol is one of the biofuels for which most research evidence is available. An evaluation of six different analyses by Alexander Farrell et al, published in Science in January 2006[38] reveals a wide range of methods used and different results reached. The authors conclude that corn ethanol brings small greenhouse gas savings of 13% compared to petrol, but only if soil erosion and land conversion are ignored. This study, in turn has been criticized some scientists[39]. Alexander Farrell and his colleagues said in response to this criticism: "Including incommensurable quantities such as soil erosion and climate change into a single metric requires an arbitrary determination of their relative value." Yet soil erosion implies the loss of soil organic carbon and a need to use further energy and fertilizer input (with more nitrous oxide emissions) to be able to farm the land. We do not believe that studies which ignore climate change impacts and soil erosion should be the basis for policy making.

Life-cycle assessments (LCAs) generally take no account of land-use change, which accounts for the greatest carbon emissions linked to biofuel production. LCAs cannot take account of the indirect effects on deforestation and ecosystem destruction. One can measure emissions linked to the production of corn ethanol, but that corn may be grown at the expense of soya and, as a result, soya plantations in South America might be expanding and might cause more deforestation, resulting in very large carbon emissions.[40] Alternatively, one can measure emissions from soya plantations which displace traditional farmland, without then measuring emissions from deforestation which may result from the displacement of local communities. Given that LCAs do not measure those wider impacts, we cannot rely on them giving us an idea of the full climate change impact of biofuel production. Nor can LCAs account for the uncertainties over secondary climate impacts from nitrogen fertilization, or feedback mechanisms from deforestation.

Can standards or certification avoid the risks of biofuels accelerating global warming?

There is a proven link between monoculture expansion and deforestation, and we know that further deforestation can result in non-linear 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. As we have said, those are not risks which we can afford to take.

Those are not simply 'negative impacts' which can be reduced – they are not comparable to limited pollution over a small area, for example, which could be mitigated.

There are several proposals for certification, though it is not clear how they would be enforced, and there is no agreement what should be included and how compliance would be audited.

None of those proposals, however, deal with the macro impacts of biofuel production. It is of grave concern that important policies being formulated at national and international levels are being based on incomplete information which distorts the actual severity of the consequences. In the absence of proven safeguards which would address not just immediate impacts of biofuel production, but the wider macro/secondary impacts too, we believe that the risks of promoting
large-scale biofuel expansion based on monocultures remains unacceptably high.

The impacts of deforestation will be the same whether biofuels 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. Nor can certification make monoculture expansion sustainable or 'climate friendly'.

Conclusion:

We are very concerned that biofuel expansion is accelerating climate change through deforestation, ecosystem destruction, peat drainage, soil organic carbon losses, and the wider effects of increased nitrate fertilization. We do not believe that life-cycle greenhouse gas assessments, which only look at the micro-level, can capture those wider impacts. Even at the micro-level, there is little scientific consensus, and there are large uncertainties.

We are concerned that biofuel policies are being developed without any proper risk analysis having been done. The impacts from the 'worst case scenarios' such as the complete destruction of South-east Asia's peatlands, or the irreversible die-back of the Amazon forest are of such magnitude that they clearly are not risks worth taking. We fear that policies are being developed based on micro-studies, and ignore important secondary impacts which have far-reaching consequences. The wider impacts on loss of natural ecosystems and the global climate have been under-estimated or ignored. Assessment of the evidence demonstrates that when macro secondary impacts are considered, the net impact of increased global biofuels production is likely to be a reduction of natural carbon sinks and an overall increase in greenhouse gas emissions.

It is of grave concern that important policies being formulated at national and international levels are being based on incomplete information which distorts the actual severity of the consequences. In the absence of proven safeguards which would address not just immediate impacts of biofuel production, but the wider macro/secondary impacts too, we believe that the risks of promoting large-scale biofuel expansion based on monocultures remain unacceptably high.

Glossary:

dd

References:

1) Stern Review Report on the Economics of Climate Change, 2006, http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
2) Global Oil Outlook: Demand and Supply, Claude Mandil, Executive Director, International Energy Authority, 12th February 2007, http://www.iea.org/textbase/speech/2007/mandil/london_ip.pdf
3) Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 1990-2020, U.S. Environmental Protection Agency, 2006, Table 1-2., http://www.epa.gov/nonco2/econ-inv/downloads/GlobalAnthroEmissionsReport.pdf
4) Mosier, A. R. and Zhu, Z. L. (2000) 'Changes in patterns of fertiliser nitrogen use in Asia and its consequences for N2O emissions from agriculture systems', Nutrient Cycling in Agroecosystems, vol 57, no 1, pp107-117
5) Intergovernmental Panel on Climate Change, Climate Change 2001: The Scientific Basis, Chapter 4, 4.2.1.2., http://www.grida.no/climate/ipcc_tar/wg1/136.htm
6) Livestock's Long Shadow: Environmental Issues and Options, published by the United Nations Food and Agriculture Organisation, p.50 http://www.virtualcentre.org/en/library/key_pub/longshad/A0701E00.pdf
7) Emission of nitrous oxide from soils used for agriculture, JR Freney, Nutrient Cycling in Agroecosystems, Volume 49, Numbers 1-3 / July, 1997
8) See UNEP Press release "Dead Zones Emergin as Big Threat to 21st Century Fish Stocks", UNEP News Release 2004/14, http://www.unep.org/GC/GCSS-VIII/PressRelease_E2.asp
9) Nitrogen rain makes bogs contribute to climate change, Håkan Rydin, 2006, http://www.chemlin.net/news/2006/dec2006/nitrogen.htm
10) see for example Andre Faaij, Global Potential for Biofuels, presentation to the IEA and the United Nations Foundation, June 2005, where he says: "Most optimistic scenario: intensive agriculture concentrated on better quality soils" http://www.unfoundation.org/files/misc/biofuels_presentations/Faaij_Biofuels_files/frame.htm; and also 'Biofuels for Transportation: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century', http://www.bioenergy-world.com/americas/2006/IMG/pdf/Biofuels_for_Transport_Worldwatch_Institute.pdf
11) Jenkinson, D.S. et al (1987) Modelling the turnover of organic matter in long-term experiments at Rothamsted. INTECOL Bulletin 15, 1-8. Abstract: http://eco.wiz.uni-kassel.de/model_db/mdb/jenkinson.html
12) Wells-to-Wheels Report 2006, JRC-IES, download from http://ies.jrc.cec.eu.int/wtw.html
13) see (6), p.51.
14) A quickscan of global bioenergy potentiasl to 2050, Published in Progress in Energy and Combustion Science (2006, in press) Edward M.W. Smeets, André P.C. Faaij, Iris M. Lewandowski and Wim C. Turkenburg 2006, http://www.bioenergytrade.org/t40reportspapers/otherreportspublications/fairbiotradeproject20012004/00000098ae0d94705.html
15) Changes in Soil Organic Carbon Contents and Nitrous Oxide Emissions after Introduction of No-Till in Pampean Agroecosystems Haydée S. Steinbach* and Roberto Alvarez, Published in J Environ Qual 35:3-13 (2006), http://jeq.scijournals.org/cgi/content/abstract/35/1/3].
16) Monitoring CO2, CH4, and N2O Emissions from Soil in Agricultural Fields in Central Missouri, Nsalambi Nkongolo et.al, http://a-c-s.confex.com/a-c-s/usda/techprogram/P29204.HTM
17) see: http://www.worldlandtrust.org/news/2005/06/just-how-green-are-biofuels.htm
18) Macedo, Copersucar Technological Centre, Greenhouse Gas Emissions and Avoided Emissions in the Production and Utilization of Sugar Cane, Sugar and Ethanol in Brazil: 1990-1994
19) see Policies and practices in Indonesian wetlands, Wetlands International, 2005, http://www.tropenbos.nl/news/mini%20symposium%20Wardojo/Marcel%20Silvius%20-%20Tropenbos2-7-'06.pdf
20) http://www.biofuelwatch.org.uk/SE_Asia_palm_biodiesel_analysis.doc
21) "Peat CO2, Assessment of CO2 emissions from drained peatlands in SE Asia", Hooijer, Silvius, Wösten and Page, 2006 http://www.wetlands.org/publication.aspx?ID=51a80e5f-4479-4200-9be0-66f1aa9f9ca9
22) Page, S.E., F. Siegert, J. O. Rieley, V. Boehm Hans-Dieter, A. Jaya, and S. Limin. 2002. The amount of carbon released from peat and forest fires in Indonesia during 1997. Nature 420: 61. 65
23) see(6), p. 90
24) Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon, Douglas C. Morton et al, PNAS **2006 103: 14637-14641 , http://www.pnas.org/cgi/content/abstract/0606377103v1?ck=nck**
25) see for example Old-Growth Forests Can Accumulate Carbon in Soils, **Guoyi Zhou et a;,** *Science* 1 December 2006:, Vol. 314. no. 5804, p. 1417, DOI: 10.1126/science.1130168#
26) same as (24)
27) Amazon Scenarios, Woods Hole Research Centre, http://www.whrc.org/southamerica/amaz_scen.htm
28) for example Climatic variability and vegetation vulnerability in Amazonia L. R. Hutyra et al, GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L24712, doi:10.1029/2005GL024981, 2005 and also A new climate-vegetation equilibrium state for Tropical South America Marcos Daisuke Oyama and Carlos Alfonso Nobre, GEOPHYSICAL RESEARCH LETTERS, VOL. 30, NO. 23, 2199, doi:10.1029/2003GL018600, 2003
29) http://www.ecoearth.info/shared/reader/welcome.aspx?Linkid=58636
30) see http://news.mongabay.com/2005/0919-nasa.html
31) UNEP Press Release, 29th November 2005, http://www.pnuma.org/informacion/noticias/2005-11/29nov05e.doc

32) Carbon Sequestration and Trace Gas Emissions in Slash-and-Burn and Alternative Land Uses in the Humid Tropics, Alternatives to Slash And Burn Working Group, October 1999, see http://www.asb.cgiar.org/pdfwebdocs/Climate%20Change%20WG%20reports/Climate%20Change%20WG%20report.pdf
33) see for example (14): That report states that it is based on the presumption that there will be no climate change between now and 2050.
34) Climate Change 2007: The Physical Science Basis, Summary for Policy Makers, Intergovernmental Panel on Climate Change,http://www.ipcc.ch/SPM2feb07.pdf
35) see http://www.globalenvision.org/library/1/1462/
36) Commodity Intelligence Report, 21st June 2006, U.S. Department of Agriculture and Foreign Agricultural Service, http://www.pecad.fas.usda.gov/highlights/2006/06/europe_20_june_2006/
37) Note: A European study, on the other hand, "Energy and greenhouse gas balance for Europe - an update" by CONCAWE ad hoc group on Alternative Fuels, Report 2/02 [http://www.senternovem.nl/mmfiles/26601_tcm24-124161.pdf] suggested that uncertainties were such that it was impossible to say whether greenhouse gas savings from rapeseed methyl esther were 7% or 58%, neither figure including soil organic carbon losses.
38) "Ethanol can contribute to energy and environmental goals" by Alexander Farrell et al, Science Vol 311, 27.1.2006. Source: http://rael.berkeley.edu/EBAMM/FarrellEthanolScience012706.pdf
39) LETTERS Energy Returns on Ethanol Production
Cutler J. Cleveland, Charles A. S. Hall, Robert A. Herendeen;, Nathan Hagens, Robert Costanza, Kenneth Mulder;, Lee Lynd, Nathanael Greene, Bruce Dale, Mark Laser, Dan Lashof, Michael Wang, Charles Wyman;, Robert K. Kaufmann;, Tad W. Patzek;, Alexander E. Farrell, Richard J. Plevin, Brian T. Turner, Andrew D. Jones, Michael O'Hare, and Daniel M. Kammen (23 June 2006)
Science 312 (5781), 1746. [DOI: 10.1126/science.312.5781.1746
40) The FAO Food Outlook No. 2, December 2006 states: "The price depressing effect of large stocks could be offset by continued strength in feed grain prices, which, eventually should stimulate oilmeal demand. The futures market tends to point into this direction: by late November 2006, the CBOT March contract for soybeans was about US$50 per tonne (or 23 percent) higher than the corresponding value of 2005 and, since September 2006, the development of soybean futures prices has been strongly influenced by maize futures." , http://www.fao.org/docrep/009/j8126e/j8126e00.htm

41) www.wetlands.org/getfilefromdb.aspx?ID=b16d46c5-ea7b-469a-a265-408b59aab5d1 (PDF file)