



## **Stern Review of the Economics of Climate Change, Soil Association evidence to HM Treasury December 2005**

### **Executive Summary**

- the industrialisation of agriculture in developing countries will cause major increases in energy demand and greenhouse gas (GHG) emissions, due to the rise in the use of energy-intensive N fertiliser and other synthetic farm inputs
- the urbanisation of the majority agrarian populations of the developing world will cause energy demand and emissions to rise substantially
- greater weather extremes will threaten continuity of food supplies
- the rise in energy prices will make input-based food production, food processing and food trade progressively more costly. Organic farming, unprocessed and local food should become more viable
- widespread organic farming would reduce flooding, reduce the vulnerability of food production to drought and energy price rises, and reduce demand for water
- widespread organic farming would also double the energy efficiency of food production and halve agricultural GHG emissions, mainly because of its non-use of N fertiliser
- the Government should assess the benefits of organic farming for climate change and adopt strategies to increase organic food and farming to 30% by 2020 in the UK and to relocalise the food economy.
- soil carbon and international transport emissions should be included in national and international inventories and targets
- the Government should open a debate on the climate change and food security impacts of the liberalisation of agricultural trade
- development policies which promote industrial and trade orientated agriculture should be abandoned

### **A. Introduction**

The Soil Association exists to achieve sustainable and healthy food by organic farming. We are the main organisation and certifier for organic food and farming in the UK, certifying about 70% of the organic food sold in the UK.

Sales of organic food are now worth over £1.2 billion in the UK and the market is growing by around £2.3 million a week. It is the fastest growing sector of agriculture. About 77% of UK households buy some organic food (TNS poll of

15,000 households). Organic farming is based on internationally recognised production standards and a certification system. There is a well functioning and expanding international market in organic produce. The global market is estimated at £15.5 billion and a very large number of countries are engaged and investing in organic farming.

Organic farming is the most sustainable farming system. It is a management-based approach based on using natural ecological and biological processes *in situ* on the farm, rather than using synthetic chemical inputs which have to be manufactured and transported from elsewhere (the basis of non-organic agriculture). This approach avoids or reduces most of the environmental problems of non-organic farming systems, including halving the energy used in the production of food. Organic farming also reduces soil erosion, agrochemical pollution and waste, and supports substantially higher levels of farmland wildlife than non-organic farming. The Sustainable Development Commission has called organic farming the “gold standard” for agricultural sustainability.

Because of its proven environmental benefits the Government wishes to expand organic farming. DEFRA adopted an action plan for organic food and farming in 2002, with a target that 70% of the UK organic food market should be supplied by UK farmers by 2010, and for public food procurement to involve the purchasing of organic food. Organic farming now accounts for 4% of UK farmland. There is enormous potential for the expansion of organic farming in this country and globally, with considerable benefits for mitigating and adapting to climate change.

## **B. Implications for energy demand and GHG emissions of the prospects for economic growth in developed and developing countries**

The main challenge in the agricultural sector is the industrialisation of agriculture in developing countries and continued industrial trends in developed countries. Energy demand and emissions can be expected to rise substantially due to three factors: the increasing use of nitrogenous fertiliser; the growth in international trade in farm inputs and food; and the urbanisation of agrarian rural populations.

### **The global rise in use of nitrogenous fertiliser**

Globally, the main concern for agriculture is the high and rising use of nitrogenous (N) fertiliser around the world. The manufacture, transport and use of fertiliser are a major use of energy and source of greenhouse gas (GHG) emissions.

UK fertiliser consumption is about 1.4 million tonnes of nitrogen (of which c.550,000t are imported).<sup>1</sup> Though demand in the UK and Europe has stabilised, worldwide use is growing fast and the fertiliser industry is expanding around the world.<sup>2</sup> Global consumption of N fertiliser was 82 million tonnes in 1998/9, up 7%

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<sup>1</sup> Fertiliser Manufacturers Association

<sup>2</sup> “The fertiliser industry and its energy use”, Gerlagh and van Dril, 1999

since 1990. Most investment is now taking place in countries such as India, China, Indonesia and Latin-America, where there is growing demand and (relatively) low production.<sup>3</sup>

This expansion will greatly increase the demand for energy. The fertiliser industry is one of the most intensive energy users in the chemical industry which itself is the largest industrial user of primary energy both globally and in the UK. The current best estimate for the energy used in the manufacture of N fertiliser is 40.61 MJ/kg N (by Sheffield Hallam University in a 2003 report for Defra<sup>4</sup>. This represents recent average production in the EU and includes infrastructure, packaging and transport.) Though modern manufacturing plants can be far more energy efficiency (the most efficient Dutch plants use 28 MJ/kg<sup>5</sup>), the global expansion of the fertiliser industry clearly represents a major challenge to energy supplies.

This expansion will mean a large increase in greenhouse gas emissions. Fertilisers are the largest source of carbon dioxide emissions in agriculture and the single largest source of nitrous oxide emissions in the world. The manufacturing process for N fertiliser is not only highly energy intensive but causes the emission of large quantities of nitrous oxide. The current best estimate for the GHG emissions from the manufacturing and transport of fertiliser are 6.7 kg CO<sub>2</sub> equivalent per kg N (all CO<sub>2</sub>, nitrous oxide and methane emissions)<sup>6</sup>. The Norwegian fertiliser industry has estimated that fertiliser manufacturing accounts for 1.2% of the world's total energy consumption and 1.2% of all GHG emissions.

However, there are significant additional down-stream GHG emissions from the use of fertiliser which are not included in these estimates: large quantities of nitrous oxide are emitted when fertiliser is applied to land; lime needs to be added soil to counter the acidifying effect of fertiliser, and production of this requires produces carbon dioxide; fertilisers also suppress the natural soil methane oxidation process, causing levels of atmospheric methane to be higher than they would be otherwise.

Currently, half of global food is grown with N fertiliser<sup>7</sup>. If fertiliser is also used for the other half, there will be large increases in energy demand and GHG emissions from agriculture.

### **Growth in international trade in farm inputs and food**

The industrialisation of agriculture and the centralisation of food distribution in the developed world have led to a large increase in long-distance transport. If this trend continues and if such changes are introduced throughout the developing

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<sup>3</sup> "The fertiliser industry and its energy use", Gerlagh and van Dril, 1999

<sup>4</sup> Mortimer N. D., Cormack P., Elsayed M.A. and Home R.E., 2003. Evaluation of the comparative energy, global warming and socio-economic costs and benefits of biodiesel, Final Report for the Department for Environment, Food and Rural Affairs, [www.defra.gov.uk/farm/acu/research/reports/nf0422.pdf](http://www.defra.gov.uk/farm/acu/research/reports/nf0422.pdf)

<sup>5</sup> "The fertiliser industry and its energy use", Gerlagh and van Dril, 1999

<sup>6</sup> Mortimer *et al*, 2003

<sup>7</sup> "Nitrogen UK", 2005, University of Warwick

world, there will be a large increase in demand for transport fuel and GHG emissions from transport.

In the UK, the transport of agricultural inputs and agricultural and food products account for 49% of all domestic freight<sup>8</sup>. The issue of 'food miles' and the reasons for the growth in food transport are well recognised: the development of centralised food distribution (supermarkets), the rise in demand for exotic foods, the liberalisation of global agricultural trade, and the rise in airfreight. What is less well known is the rise in the transport of farm inputs that is associated with the intensification of farming. One of the main features of industrial agricultural systems is the dependency on inputs produced elsewhere and transported to the farm: fertiliser, pesticides, veterinary drugs and animals feed grains. This is a major change from traditional (and organic) farming systems which do not need such inputs, as most of the resources needed are produced on the farm (for example, nitrogen-fixing legumes and livestock manures replace the need for fertiliser).

### **Urbanisation of the rural agrarian population**

Probably the single largest increase in energy demand and GHG emissions in the developing world, if current models of development are pursued, will be from the urbanisation of the currently largely rural populations. In the developing world, most people live in rural areas and work on the land as subsistence farmers: £600million in India, £400 million in Africa, and 90% of the people in Rwanda, for example. If these whole populations give up subsistence farming, move to cities (mirroring the situation in, say, Britain, where only 1% of the population are now engaged in agriculture) and adopt Westernised lifestyles (buying industrially produced food in supermarkets etc.), the energy demand and emissions per head will rocket to the levels of the developed world.

### **International growth in organic food and farming**

One positive trend that comes with increasing economic prosperity is the rise in demand for certified organic food. In the UK, organically produced food is twice as energy efficient as non-organic farming (according to Defra<sup>9</sup>) and organic farming produces less than half the GHG emissions of industrial agriculture in developed countries (according to a US study of a long-term trial<sup>10</sup>). Moreover, organic or agro-ecological practices in developing countries situations, where the practices are improving the productivity of traditional methods, are likely to have far lower, and probably minimal, energy demands and emissions. Unfortunately, although the world organic market is growing, the benefits of this trend are probably being far outweighed by the negative impact of the progressive industrialisation of agriculture.

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<sup>8</sup> 2003 Transport Statistics for Great Britain 2004, Department of Transport

<sup>9</sup> "Energy use in organic farming systems", ADAS report to MAFF, 2000

<sup>10</sup> "Greenhouse Gases in Intensive Agriculture: Contributions of Individual Gases to the Radiative Forcing of the Atmosphere" by GP Robertson, EA Paul and RR Harwood; Science, Vol 289, pages 1922-1925, 15.9.2000 ([www.sciencemag.org](http://www.sciencemag.org))

### **C. Economic, social and environmental consequences of climate change, and actions to adapt to a changing climate**

Climate change threatens crop production and thus periodic food shortages and price rises are possible. The economic and social problems of this will be exacerbated by the expected rise in energy prices. On the other hand, the rise in energy prices should also promote various positive changes that will reduce agricultural emissions and improve the adaptation to climate change, such as supporting the expansion of organic and local systems of production.

#### **Weather impacts on food production**

Food supplies are uniquely vulnerable to climate change and also uniquely important for national security because food cannot be stored over long periods in the way that other commodities can. In the UK and worldwide, climate change will bring greater volatility and greater extremes of weather such as more periods of drought and intense rainfall. These will make it harder for farmers to plan and manage their crop production, and crop failures from drought will become progressively more common.

Conventional intensive agricultural systems are very susceptible to the effects of extreme weather such as drought. As an example, the drought conditions associated with the prolonged heatwave in central and southern Europe in summer 2003, caused estimated crop losses of c.\$12.3 bn. Such events are predicted to increase 100-fold over the next four decades, so that by the 2040s more half the summers would be warmer than 2003 and by the end of this century a summer like 2003 would be unusually cold.<sup>11</sup>

Such conditions would threaten the regional and global continuity of food supply, which may mean periodic food shortages and rises in food prices. As food is so basic to the welfare of people and a significant proportion of expenditure for most populations, this could have serious social and economic impacts. The reality and severity of the impacts of climate change on food availability are, however, hard to gauge as there is, on the other hand, considerable potential for increasing food production in many countries such as those in Eastern Europe.

Countries which are likely to be particularly vulnerable are those which are heavily reliant on food imports, such as the UK, and also those developing countries which are already susceptible to drought and whose ability to distribute or buy food are limited by poor internal transport systems and a lack of financial resources.

#### **'Peak Oil' impacts**

The forthcoming peak and gradual run-down in global oil and gas supplies, predicted by industry analysts, will greatly exacerbate the problems of climate

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<sup>11</sup> under the SRES A2 scenario with the HADCM3 climate model, Nature, 2.12.2004

change. 'Peak Oil' will mean greater volatility of oil prices and a long-term increase in energy prices.

This will particularly impact on the price of N fertiliser and thus the cost of fertiliser-based farming. As an example of the susceptibility of non-organic agriculture to energy prices, the cost of fertilisers accounted for about 8% of the costs of cereal production in 2002. However, because of ballooning gas prices, 2005 UK fertiliser prices are now the highest ever and still rising. At current (begin December) gas prices, N fertiliser prices would significantly exceed £200/t, double the £100/t four years ago. Not only will this increase the cost of crop production in the developed world but this may cause a reduction in agricultural production in developed countries. In October this year, the UK farming press was reporting that "the high [fertiliser] prices are making second crops such as second wheat difficult to justify"<sup>12</sup>.

The rising cost of electricity will also make the factory farming of livestock (most UK pig and poultry) and also food processing more costly and less viable. The costs of food transport and thus food imports and distribution will also increase. Thus, food prices are expected to rise progressively. For example, Kraft Foods recently reported that it would be increasing its prices by 3.9% in the US because of a rise in energy and packaging costs caused by the rise in global oil prices.<sup>13</sup>

On the other hand, the rise in energy prices means that the comparative economic viability of organic, local, outdoor reared and unprocessed food will improve. This would bring a range of environmental and health benefits to society, including lower energy demand and GHG emissions and the important adaptation benefits listed below.

### **Adapting to a changing climate**

The key measure that can be taken in agriculture for adapting to climate change is widespread conversion to organic farming. Several features of organic farming mean that it places society in a better position to meet the challenges of climate change:

(i) Helps reduce the risk of flooding – The water absorption of agricultural land is an important factor in the risk and severity of flooding. Organically managed soil has a better structure because of its use of organic matter instead of inorganic fertiliser. This means that organic farmland is better able to absorb water in periods of extreme rainfall than non-organic land, leading to less run-off and reducing the likelihood of flooding downstream. For example, measurements taken in 1995 by the Rodale Institute in the US from its long-term trial of organic and non-organic farming found that the water infiltration rates were twice as high in the organic system than the non-organic.

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<sup>12</sup> [www.fwi.co.uk](http://www.fwi.co.uk)

<sup>13</sup> "Kraft feels the pressure of rising energy and packing costs", 17.11.2005.  
<http://www.bakeryandsnacks.com/news>

(ii) Produces more food in drought periods - organic farming produces far higher yields than non-organic farming in drought periods and/or can withstand drought conditions for longer. For example, the Rodale Institute in the US found that, while the yields from non-organic farming were highly susceptible to drought (for example, the soya yield fell 66% in the drought year), the organically managed crops were not as affected. The organic soya yielded 53% more than the non-organic soya, and the organic maize yielded on average 27% more than the conventional maize in the four drought years for maize during the period of the trial. Similarly, recent experience in Ethiopia found that organic crops last a fortnight longer in droughts before wilting than fertilised crops, which can mean the difference between having a harvest and not. Organic crops are more resilient to drought because of the use of organic matter instead of fertiliser, which means the soils retain moisture longer and the crops have deeper root systems. Widespread organic farming will therefore reduce the risk of food security problems arising as a result of increasing droughts.

(iii) Uses less water – organically managed crops have less need for irrigation, since they resist drought conditions better. This means there will be less pressure by agriculture on water resources. This will be increasingly valuable as the demand for water from (non-organic) agriculture and other sectors of society is expected to increase with global warming. As the demand for agricultural irrigation would occur at times of national water shortage, the reduced need of organic crops of irrigation would be an important practical benefit.

(iv) Being independent of the need of fossil fuels – non-organic agriculture is inescapably reliant on fossil fuel through its use of nitrogen fertiliser, which is produced from natural gas as the main feedstock. As organic farming does not use N fertiliser, it has no specific need for fossil fuel and already uses half as much energy because of its minimal use of farm inputs. Organic farming should be an increasingly viable and less economically vulnerable food production system as energy prices rise and provides a technically viable alternative for a world which must move away from the use of fossil fuels.

### **Promote agricultural genetic diversity**

Agricultural policy should also invest in maintaining a diversity of plant varieties and animal breeds. High genetic diversity is a key insurance policy for maintaining food supplies against the future effects of climate change. If there is high genetic diversity, crop failures or disease outbreaks are far more likely to remain local or limited to certain varieties/breeds instead of becoming epidemics that destroy the whole of an agricultural sector with consequent national economic and social implications. Governments should therefore encourage the use of traditional and local breeds and the breeding by farmers for local conditions.

## **D. Actions to reduce GHG emissions**

### **Expansion of organic farming**

One measure stands above all others in its ability to reduce the energy demand and climate change impacts of agriculture: the expansion of organic farming. It is the low-carbon solution for farming and should be recognised as such in the way that renewable energy is seen as the sustainable alternative to fossil fuel energy. With organic farming, crop and livestock production would be twice as energy efficient as now (according to Defra 2000 data) and GHG emissions would be reduced by at least the same amount (a US study assessed the overall global warming potential of organic crop production as 43% of that of non-organic per unit of food produced). Organic farming would also bring the adaptation benefits listed above, and a range of other environmental benefits. It also has high public support.

Organic farming has such a positive impact on agricultural energy demand and emissions because it removes the main source of energy use and emissions in farming, the use of N fertiliser. The energy consumed in fertiliser production and transport to the farm accounts for 54% of the total direct and indirect energy used by UK agriculture (ADAS data, 2002). It can be calculated that the manufacture and transport of the fertiliser used in the UK accounts for 1.4% of the UK's GHG emissions.<sup>14</sup> However, as mentioned, the actual total GHG emissions caused by the use of N fertiliser are far higher because of the additional downstream emissions. Also, these estimates do not include the N fertiliser used to produce imported food and food imports now account for a high proportion of the UK's food.

Additionally, organic farming avoids much of the transport of farm inputs (not just fertiliser, but also pesticides, veterinary drugs and animal feed grain) which are needed for non-organic farming and which account for a high proportion of domestic and international transport. Overall, organic farming is much more energy efficient as it uses natural biological and ecological processes *in situ* on the farm instead of using synthetic external inputs.

Widespread organic farming would also counter the very significant CO<sub>2</sub> emissions from soil that have recently been quantified in the UK. Soil is major store of carbon, containing about twice as much as the atmosphere. But the completion of a 25-year UK soil survey by the National Soil Resource Institute has found that soil is losing carbon "on an enormous scale". They estimate that 13 m t of carbon are being lost from UK soils *each year*, equivalent to 8% of the UK's CO<sub>2</sub> emission in 1990, more than the entire reduction achieved in UK GHG emissions between 1990 and 2002.<sup>15</sup> This is not just a UK problem. In 2003, the European Climate Change Program working group on carbon stores related to agricultural soils concluded, "there is evidence that under current agricultural practices, many European soils

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<sup>14</sup> Soil Association calculation: 1,375,000 t N applied in the UK x 6.7kg CO<sub>2</sub>/kg N = 9.2 mt CO<sub>2</sub> equivalent. Total UK carbon emissions were 178 million t of C in 2005 x 44/12 = 652.7mt CO<sub>2</sub> (Source: UK Climate Change programme review, 2005). 9.2 mt ÷ 653 mt x 100 = 1.4% of total UK CO<sub>2</sub> equivalent emissions.

<sup>15</sup> "Carbon losses from all soils across England and Wales 1978-2003", P.Bellamy *et al*, Nature, Vol 437, 8.9.2005.

are losing organic carbon and thus constitute sources of atmospheric CO<sub>2</sub> rather than sinks”<sup>16</sup>.

Farming is the main land use in the UK and organic farming would prevent most of these losses and can even sequester carbon in agricultural soils. This is because it is based on the addition of organic matter to soil instead of using inorganic fertiliser. This builds up carbon in the soil. For example, the long-term trial of organic farming by the Rodale Institute in the US found that organic farming increased soil carbon levels by 15-28% (from about 1.8% to about 2.3%). If organic farming was adopted nationally, the researchers calculated that this would absorb 1 to 2% of the carbon dioxide released from the combustion of fossil fuels in the US.

Finally, by not using fertiliser, organic farming maintains the role of soil micro-organisms in controlling atmospheric methane. 10-15% of atmospheric methane is oxidised in aerobic soils and it is estimated that the atmospheric concentration of methane would be double without this sink (Ojima *et al*, 1993). Research by IACR-Rothamsted has found that agriculture decreases natural soil oxidation rates by up to 80%. In particular, they found that the use of ammonium based N fertilisers, which makes up the majority of nitrogenous fertilisers used in the UK, causes a major reduction in soil oxidation rates in proportion to the amount of fertiliser applied (in contrast, the use of cattle manure has little effect.)<sup>17</sup>

Organic farming is an already existing, technically viable approach. Substantial expansion to say 30% of UK (and European) food and farming would be a realistic change which would bring substantial benefits for climate change. We therefore believe, in the same way that the Government has promoted energy efficiency and adopted targets for renewable energy and energy efficiency, it should promote the benefits of organic production to the public and businesses, and adopt ambitious increasing targets for the public procurement of organic food and for organic food as a percentage of all food sold.

In particular, the Government should take responsibility for addressing the climate change impact of its share of the food sector by requiring its food purchasing operations to buy organic and local food. The public food purchasing sector in England accounts for over £1.8 billion a year on food and catering services. Opportunities for encouraging businesses to buy increasing proportions of their food from local organic sources should be also investigated and promoted. Some businesses purchase considerable quantities of food, yet buying organic food is not yet recognised as the best environmental option for food in the way that recycling is now seen as the norm for paper management.

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<sup>16</sup> Final Report on Working Group on Sinks Related to Agricultural Soils, Second ECCP Progress Report – Can we meet our Kyoto targets? European Climate Change Programme 2003

<sup>17</sup> “Farming, Fertiliser and the Greenhouse Effect”, T. Willison, K. Goulding, D.Powlson and C. Webster. Outlook on Agriculture, Vol. 24, No.4.241-247 (1995).

We therefore propose: (i) an assessment of the climate change and other benefits of widespread organic farming; (ii) a strategy to develop organic farming to at least 30% of food and agriculture by 2020; (iii) increasing the on-going support for organic farming to levels similar to the average European levels (iv) a public promotion campaign for organic food; and (v) public food procurement targets for 30% organic by 2015.

A policy for expanding organic farming to 30% of food and agriculture would have a range of other benefits including:

- the climate change adaptation benefits listed above
- reduction in agricultural pollution, because of its minimal use of agro-chemicals
- considerably reduced agricultural waste, which accounts for 20% of the UK's annual waste (Defra figures, 1998-2002), as it is not reliant on external inputs
- more wildlife in the countryside
- there would be behavioural and learning benefits for school children, based on current experience with introducing organic food
- reduced external costs of agriculture

The only difficulty of expanding organic farming is that, although it should considerably reduce the overall cost of food and agriculture to society, and increasingly so as climate change and 'peak oil' take effect, the farmgate and retail costs of organic food are currently higher than non-organic farming because the external costs are not internalised in agriculture. As energy prices and water costs rise, however, this market price discrepancy should progressively reduce.

### **Reduce agricultural input and food transport**

The second important action we propose is to relocalise the agricultural and food economy. Current transport policies for climate change objectives are focussed on improving the efficiency of cars and fuels. However, Governments must have policies to reduce the need for transport to constrain demand for transport fuel. EU road traffic is growing at 2% per year and CO<sub>2</sub> emissions from road transport are projected to grow 9% between 2000 and 2010. This would, for example, negate any contribution from biofuels within a couple of years. Agricultural inputs, products and food account for half of all domestic freight and so must be tackled. Organic farming and a relocalised food economy are the keys to reducing this transport.

The expansion of organic farming would significantly reduce the transport of farm inputs as it is largely self-sufficient system that does not require inputs in the way that non-organic production does. Additionally organic farming supports the development of a localised food economy. Unlike non-organic farming, which has gone down the route of product specialisation and intensification and is more suitable for centralised distribution systems, organic farming is more suitable for local food marketing as it produces a greater diversity of products from each farm and has much more publicly acceptable methods. Already twice as many organic

farmers market their produce direct to the public than non-organic farmers, such as through farm shops, vegetable box schemes and farmers' markets.<sup>18</sup>

The Government should adopt strategies to develop organic farming and local food economies. People, caterers and public food purchasers should be encouraged to buy food locally and directly from farmers. Methods of buying food locally should be promoted. Later opening hours for local food shops would significantly increase access for working people to local shops. The Government and RDAs should support the development of local food infrastructure.

Local food should be developed by: (i) a strategy to develop local food economies including the development of infrastructure and (ii) public food procurement targets for 50% local food by 2015.

#### **D. Effectiveness of national and international policies**

Existing measures are failing to deliver reductions in CO<sub>2</sub> emissions: there has been no progress in reducing UK emissions since 1997 and much more needs to be done if "real progress" towards the 60% target is to be made. More also needs to be done to reduce nitrous oxide emissions which are not projected to fall. The following are the main areas where we think current policies are failing in agriculture.

#### **Climate change policies are not addressing the main emissions in agriculture**

The agriculture industry is a very large source of the major greenhouse gases. However, it appears to us that the main emissions are being almost completely neglected.

We are concerned that Defra has not fully recognised and quantified the emissions and overall impacts of agriculture on climate change. Officially, agriculture accounts for 8% of the UK's greenhouse gases. However, this only includes farm level emissions and emissions associated with the energy used at farm level, but excludes the following major sources of GHG emissions which are far more important:

- the substantial CO<sub>2</sub> and nitrous oxide emissions from the production of N fertiliser
- the transport of farm inputs
- the large losses of soil carbon
- the reduced soil methane oxidation rates due to the use of fertilisers

These emissions are substantial and yet they are not being addressed by Defra. We believe that Defra should not just focus on the agricultural emissions at the farm stage but address the emissions associated with the manufacture and transport of agricultural inputs. Part of the problem seems to be the current accounting

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<sup>18</sup> according to an ADAS survey in 2004 which found that 47% of organic farmers are likely to sell direct versus 19% of non-organic farmers

method for climate change impacts which allocates the emissions associated with the energy used by each sector but does not allocate the emissions associated with the production of other key inputs, even though these are far more significant in the agriculture sector. The emissions associated with agricultural inputs are presumably included in the emissions for the agrochemical manufacturing industry. However, this industry is limited in what it can do in reducing these emissions. The fertiliser industry, for example, can make the processes more energy efficient but the industry, and policies targeted at the industry, will never address the important question of whether the products need to be used at all. As the use of these products causes other downstream emissions and as their use is now largely technically unnecessary (due to the development of organic farming techniques), addressing the use of farm inputs must be a major part of the policy response to these emissions. It is the agriculture industry and agricultural policy-makers which are best placed to influence the use of farm inputs, but at the moment this is not part of Defra's policy response (to any significant degree).

As regards the last two sources of emissions, soil carbon and soil methane oxidation rates, the problem seems to be that the agricultural contribution to these has not been quantified. Thus, they have not been included at any stage in the national inventory of GHG emissions, even though they are direct 'end-user' agricultural emissions.

A third, but possibly significant problem, seems to be the unremitting pressure from the agricultural lobby for the development of biofuels. This is taking a considerable amount of policy attention and resources, and considerable attention in the farming press. It is not clear that this should be such a climate change priority for the Government considering the large agricultural emissions that remain unaddressed and the fact that there are many non-agricultural sources of renewable energy which can be developed. Defra should prioritise identifying, quantifying and reducing the main sources of agricultural emissions, in particular the manufacture of N fertiliser and soil carbon.

### **Current expansion of organic farming is too limited**

Current Government measures, such as the introduction of on-going support for organic farmers, should support a greater expansion of organic production. However, current measures do not appear to be effective enough for expanding organic farming to, say, 30% by 2020. The problem is that the Government is currently only supporting organic farming as a valuable 'niche' market opportunity, not as a major agricultural policy measure. The main barriers to it being a very substantial part (and eventually possibly the dominant system) of agriculture are not technical or, we believe, its productivity, but political. This includes a lack of vision and a strategic approach by policymakers to its potential. The Government should assess the benefits of organic farming for addressing climate change and for reducing society's vulnerability to oil price rises, and develop a strategy for expanding organic farming to 30% by 2015.

### **Omissions of soil C and international transport**

The emissions of soil carbon and international transport (air and shipping) are substantial contributors to climate change but are not being properly addressed. The main reason is that they are not currently included in the Kyoto Protocol targets or national inventories. This situation needs to be rectified urgently.

### **Commitments to single European market and free trade need reviewing**

The existing policy and legal barriers to developing more localised food distribution systems need to be removed. Currently, it is illegal in terms of EU law for public authorities to openly adopt local food purchasing policies on environmental grounds even though they should consider the environmental impacts of their policies. This needs to be changed.

The UK Government should also start an international debate on the impacts of international trade in food. The UK, European Union, and many other countries have been pursuing a policy of increasing food trade through trade negotiations and institutions such as the WTO. There is almost no assessment or even recognition in these discussions of the substantial climate change and food security cost of this policy. This needs to change. The UK should take a lead in opening official debate on the environmental and food security impacts of 'free' agricultural trade.

### **Lack of UK food security policy**

There is one important issue that is being omitted in Defra's efforts on agricultural adaptation, and that is food security. We are concerned that Defra is solely considering how climate change will affect the businesses of individual farmers, not how climate change will affect the output of agriculture and how this will affect public access to food. The UN FAO should assess how the expected climate changes are likely to affect the overall quantity and continuity of global food. The UK Government needs to assess the impacts on UK food production and the UK's access to imports in periods of shortages.

Another problem is that Defra is basing its agricultural adaptation efforts on stakeholder-led action. This cannot be sufficient to address the major challenges for agriculture and food supplies. For example, with the introduction of the Single Farm Payment, which now does not require farmland to be actively producing crops or livestock, it may be in the interest of many farmers to give up farming or to turn over all their land to non-food production (such as biomass/biofuels). This would increase the UK's vulnerability to food security problems as the UK is already currently highly reliant on imports and climate change may bring periods of global food shortages.

### **UK foreign policy on development of agriculture in developing countries**

We must challenge the benefits of current development policies for agriculture that envisage introducing industrial farming methods and trade-orientated agricultural systems throughout the developing world. This would substantially increase the

demand for energy and water and the GHG emissions from agriculture and the food system. This would also make the food security of developing countries far more vulnerable to drought and oil price rises (though the dependency on fertiliser). This would also mean changing the proportion of the population working on the land in developing countries from the current 60% to something close to the 1% in Britain. The urbanisation of these hundreds of millions of people would completely undermine all efforts at reducing energy demand and emissions in the developed world.

Such negative 'development' seems to us completely inappropriate and unnecessary given the more suitable alternative of expanding organic farming and other agro-ecological approaches which have important food security advantages over industrial farming. It is unacceptable that fossil-fuel dependent farming is being promoted abroad by the Government and international institutions. Agricultural systems which have proven benefits for climate change policy and other aspects of the environment, such as organic farming, should be the only agricultural systems that are promoted internationally.