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Climate friendly food consumption reduces the land area needed for food and has other substantial benefits

Research from Cranfield University and Murphy-Bokern Konzepte published today by the UK Committee on Climate Change identifies clear potential benefits of reductions in meat and dairy consumption. Adopting climate friendly diets not only reduces greenhouse gas emissions, it has other potential environmental benefits with the low risks of unwanted side-effects. Such change is also widely regarded as beneficial for health.

Food accounts directly for about 20% of greenhouse gas emissions from developed economies. This increases to about 30% when the effects of agriculture on global land use change (e.g. deforestation) are considered. Since the Cranfield University team published detailed analyses of the emissions from food production in 2006, it has become widely recognised that a reduction in livestock production consumption is central to consumption led climate change mitigation. A large proportion of British meat and dairy products are produced from grassland. The background to the research is the question of the effect of replacing meat and dairy products with plant based products on the total amount of cropland needed. An increase in the demand for crops overall would be a negative effect causing increased emissions through the conversion of land to crop production or the 'export' of emissions to other countries.

The work developed and used a combination of consumption and production scenarios to examine potential consequences of consumption and production change. Life-cycle assessment techniques were applied to these scenarios to examine the overall effects. The production under the various consumption scenarios was allocated to agricultural land resources by a combination of survey-based data analysis and model-derived calculations. Changes in the structure of the livestock sectors were simulated. Land use change (LUC) emissions (from changing soil C and biomass stocks) were calculated. The research process included the participation of industry stakeholders in the design of the scenarios tested and in the scrutiny of results and conclusions.

Major results

1. All consumption changes to reduce greenhouse gas emissions reduced the total amount of land estimated as required to support the UK food system. When livestock consumption is reduced, the amount of extra land required for the increased direct consumption of plant products is less than the amount of arable land released from livestock feed production.
2. Reducing livestock consumption reduces the need for all types of land, both in the UK and abroad.
3. Replacing beef and sheepmeat with pig and poultry meat increases the need for arable land, especially outside the UK. However, the release of good quality grassland in the UK exceeds the increase in overseas arable land needed.
4. Consumption change has huge implications for the need for agricultural land, especially grassland. Up to half of land now used for food in the UK could be released for other purposes (including exports) if the UK consumption of livestock products was reduced by 50%. The reduction is mostly in grassland.
5. The effect of converting grassland released to bioenergy production depends greatly on the type of crop grown. Using this land for maize (e.g. for biogas), oilseed rape (for diesel) or wheat

(for bioethanol) causes very large emissions of carbon dioxide from soils in the first twenty years causing an increase in greenhouse gas emissions. Using unwanted grassland for forest or other types of woodland such as short-rotation coppice will have the opposite effect – carbon is captured in soil reducing emissions. These effects are very large.

6. Reducing livestock also reduces other types of pollution such as nitrate to water and ammonia to air.

7. Much of the land released from agriculture is relatively unproductive grazed land. The dramatic reduction in the use of this land for livestock opens up opportunities for changing land use for other purposes, including rewilding.

8. A 50% reduction in livestock product consumption is feasible and aligns with healthy eating advice.

This study has clearly shown that UK land can support consumption change to reduce greenhouse gas emissions from the food system. The reduction in land needed to supply the UK that comes with a reduction in livestock product consumption brings potential environmental benefits and significant opportunities to deliver other products, including other ecosystem services, from UK agricultural land. The study has shown that some risks currently argued as arising from consumption change are small. In particular the study shows that arable land needs will not increase if the consumption of livestock products is decreased. The risk that emissions will be exported is also shown to be small. The identification of the significant potential benefits of consumption change combined with the low risks of unintended consequences has far-reaching implications for guidance to consumers and the development of agricultural policy. The results are broadly applicable to other European countries which means they are relevant to international policy development, for example the reform of the Common Agricultural Policy.

Comments on the study

The research has been warmly welcomed. Tara Garnett from the Food Climate Research Network at the University of Surrey called the report “a really fascinating piece of work”. Mike Thompson of the Committee on Climate Change described the research as “an impressive piece of analysis that carries forward the Committee’s thinking around diets and climate change mitigation”. Commenting as one of the authors, Dr Donal Murphy-Bokern said that the Cranfield team has always very carefully applied powerful mathematical techniques and models to complex questions about resource use in agriculture. This study is at the cutting edge in how land needs and greenhouse gas emissions for food production are modelled. He said that, like many who have reviewed the work, he is continuously astonished at the depth of the analysis and by the profound implications the numerous results. He also added that while focused on the UK, the work has important international implications. The conclusions are broadly transferable to other EU countries.

The report can be downloaded here: <http://www.theccc.org.uk/reports/fourth-carbon-budget/supporting-research>

Citation:

Audsley, E., Chatterton, J., Graves, A., Morris, J., Murphy-Bokern, D., Pearn, K., Sandars, D. and Williams, A. (2010). *Food, land and greenhouse gases. The effect of changes in UK food consumption on land requirements and greenhouse gas emissions*. The Committee on Climate Change.

Notes:

Dr Donal Murphy-Bokern (www.murphy-bokern.com) is an independent agricultural scientist based in Lohne in Germany. He leads international research projects, contributes to the direction of international agricultural research programmes, and works as a specialist in public policy within international research teams. The overall aim of his work is the development of resource conserving and efficient agricultural systems for food, bioenergy and renewable materials.

The Department for Natural Resources at Cranfield University (<http://www.cranfield.ac.uk/sas/naturalresources/index.html>) is a recognised world leader in the analysis of natural resource use in agriculture. In addition to being home to the UK National Soil Resources Institute, the report's authors are world leaders in the application of life-cycle assessment to agricultural products and systems.

The United Kingdom Committee on Climate Change (CCC) is an independent body established under the [Climate Change Act](#) to advise the Government on emissions targets, and to report to Parliament on progress made in reducing greenhouse gas emissions.