

Briefing 765

Climate Change, Agriculture and Food

Dr. Martin J. Hodson

Summary

Climate change is real and is caused by human activity. There will be quite major impacts on agriculture this century. Probably agriculture has been having an impact on climate for thousands of years. Agriculture remains one of the major contributors of greenhouse gases (they divide roughly - one third agriculture and food, one third from housing and one third from industry). Although the agricultural sector needs to look into decreasing emissions, this is not the only sector that needs to do so.

This summary is based on the lecture given by Dr. Martin Hodson, an environmental biologist at Oxford Brookes University at “Cherishing the Earth– challenges in food, farming and climate”, the Agricultural Christian Fellowship Conference, held on November 17th 2008 at the Arthur Rank Centre, Stoneleigh, Warwickshire.

Martin started by pointing out that climate change was not the only important issue – there are four (at least) – climate change, population, biodiversity loss and water. We need to keep this wider picture in mind.¹

Effects of Climate Change on Agriculture

Greenhouse gases (GHGs) swathe the earth – without them it would be uninhabitable with temperatures around -15°C. It is man-made increases which are causing climate change. Not many scientists disbelieve this, perhaps 40 in the world, and only about a dozen climate scientists (out of thousands).

Concentrations of methane and carbon dioxide in the atmosphere have increased greatly since pre-industrial times. CO₂ is now increasing at 2-3 parts per million a year.

CO₂ (63%) is the main contributor to global warming followed by methane (24%), nitrous oxide (10%) and others (3%).

CO₂ in the atmosphere acts as a fertiliser. It increases plant growth in laboratory conditions. However, increased growth in the field has yet to be detected as it will be masked by very much bigger influences – weather for instance.

The trend in temperatures is undoubtedly upwards but they will not rise equally everywhere. The Arctic and Africa will both be relatively badly affected by temperature increases.

¹ For more details on these issues see HODSON, M.J. & HODSON, M.R. (2008) *Cherishing the Earth. How to care for God's Creation*. Monarch Books, Oxford. Additional information is available at: <http://www.hodsons.org/cherishingtheearth/index.htm>

The Intergovernmental Panel on Climate Change (IPCC²) say that by 2100 temperatures will probably rise by between 1.8 and 4.0°C and could possibly increase by between 1.1 and 6.4°C. Most scientists hope we will hold at about 2°C. A 4-6°C rise would be very serious for planetary systems.

Some areas will get drier (e.g. the Mediterranean) and some wetter (e.g. Antarctica) where the icecap is getting thicker because of increased precipitation. Precipitation increases are very likely in high latitudes. Precipitation decreases are likely in most subtropical land regions.

Climate change is likely to lead to crop species (e.g. wheat, maize) moving north quite significantly in the Northern hemisphere.

There will be more storms, with consequent decreases in agricultural production.

An average rise in sea levels globally of between 28 and 43 cm by 2100 is predicted by the IPCC, but this excludes melting of ice caps. Large, low-lying and highly populated areas in places like Bangladesh, Egypt, China and India will flood and could generate 150 million refugees. Other delta regions and islands will also be affected. In some areas, agriculture will be dislocated, due to droughts, floods and unpredictable weather.

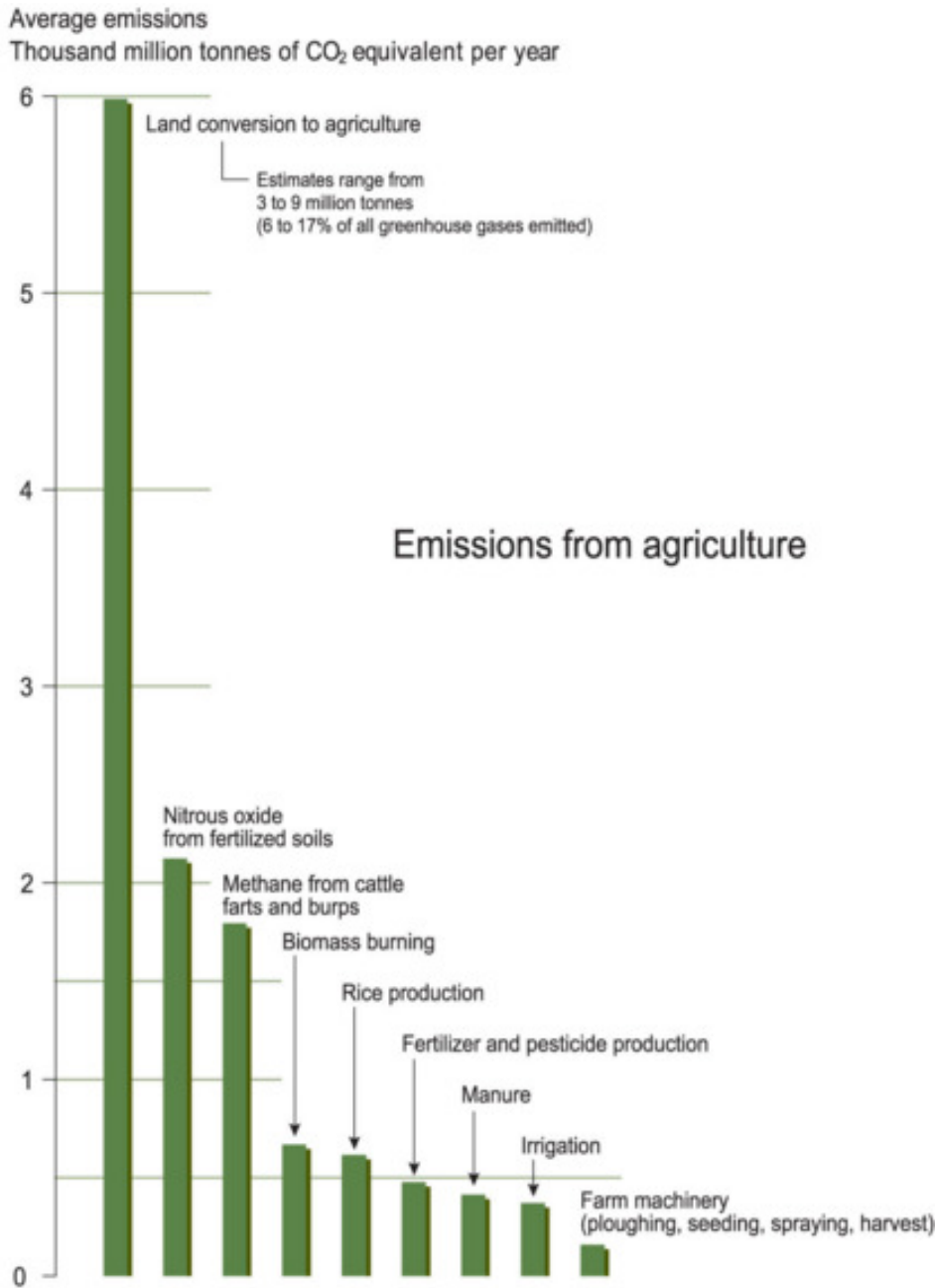
Effects of Agriculture on Climate Change

The American climatologist Bill Ruddiman has developed the “Early Anthropocene Hypothesis”. This suggests human-induced climate change may have occurred much earlier than the Industrial Revolution. At the end of the last Ice Age, 8,000 years ago, when forests were being cleared for agriculture and farmers started keeping livestock, CO₂ in the atmosphere began to rise. Later, 5000 years ago, Ruddiman suggests that methane production was stimulated by the start of rice growing in paddies. The hypothesis says that these changes in human activity were big enough to stop us moving into another Ice Age³.

² IPCC (2007) Reports of the Intergovernmental Panel on Climate Change: Climate Change 2007. They are also available at www.ipcc.ch

³ Ruddiman, W.F. (2005) How did humans first alter global climate? *Scientific American*. March 2005. pp 46-53.

Emissions from agriculture⁴



Source: Greenpeace, *Cool farming: Climate impacts of agriculture and mitigation potential*, January 2008 (data for 2005).

By far the biggest emissions are from converting land to agriculture. Next ranking is nitrous oxide from fertilisers then methane from cattle, followed by a number of other smaller factors.

Methane

The main sources of anthropogenic methane are: Landfills; Ruminants; Rice; Biomass burning; and Energy use. Cattle produce 86 million tonnes of methane per year, but diet can be changed to decrease this⁵. However, other agricultural processes such as fertilizer production are important sources of GHGs.

⁴ Figure Designer: Emmanuelle Bournay, UNEP/GRID-Arendal. See <http://maps.grida.no/go/graphic/emissions-from-agriculture>

Energy

Our appetite for out of season vegetable use has a huge cost in terms of energy. For instance 5 litres of oil are required per kg of asparagus in the winter, whereas this drops to about 0.2 litres in the summer. Some of these costs are due to transport, and some due to using heated greenhouses. French beans are similar, but the winter/summer differential is not as great for courgettes and tomatoes.

Discussion

It can be quite complicated deciding what action to take. For instance planting trees will absorb CO₂, but they die eventually and release GHGs as they decay.

In a lecture in 2007 Lord May said that we are releasing the product of a million years of photosynthesis every year.

Having lost 'farming' could we use 'environment' to start talking about it all and work farming into that? Yes but keep the stress on 'local'.

Could we reduce ploughing of arable land, and move to native breeds which can use poorer grazing? How will farmers be directed?

There is a lot of research going on (e.g. to reduce methane output from cattle). Might genetic modification have a role?

Martin Hodson, Alan Spedding, 28 January 2009

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⁵ For more details see Hodson, M.J. (2007) Methane, cattle and climate change. RuSource Briefing 464. See: http://www.arthurrankcentre.org.uk/projects/rusource_briefings/rus07/464.pdf