

Livestock casts long shadow over climate debate

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Categories : [Vets](#)

Date : May 10, 2010

Andrew Knight argues that even the Food and Agriculture Organisation of the United Nations own figures may have seriously underestimated the impact of livestock on climate change in the first of a two-part article

LEADERS of almost every nation on Earth had the undivided attention of much of the world during the 15th United Nations Climate Change Conference as they struggled to reach agreement in what was billed as “the last chance to save the planet” from catastrophic climate change.

As on so many previous occasions in our turbulent history, human selfishness sabotaged efforts to do the right thing, as squabbles over money and short-term national self-interest prevented agreement at the conference in Copenhagen.

As President Obama stated – while a sliver of hope still remained: “While the reality of climate change is not in doubt, I have to be honest, I think our ability to take collective action is in doubt right now and it hangs in the balance.” And indeed, the vague and toothless Copenhagen Accord that emerged thereafter from the dying gasps of the conference failed to set emissions targets or impose binding obligations on any country to address climate change. It was far removed from the bold plan required to prevent a 2°C global rise in coming decades – the temperature widely believed to represent an irreversible “tipping point”. Additional rises are expected to lead to runaway climate change, through mechanisms such as the melting of the Greenland ice-cap and the release of millions of tons of methane currently frozen within Arctic permafrost.

Most people who have studied this issue are beginning to understand that climate change

represents the greatest threat to life on Earth for many millennia.

The anthropogenic (human-caused) rate of species extinction is already 1,000 times more rapid than the “natural” rate of extinction typical of Earth’s long-term history, with the result that we are living through one of the very few mass extinctions. Climate change is certain to significantly accelerate this process, and threatens Earth’s habitability.

Accordingly, climate change is increasingly the focus of governments and intergovernmental bodies, such as the UN, non-governmental organisations, universities, professionals and their associations, and the general public. It was the overriding theme of the Minding Animals conference (www.MindingAnimals.com), held in Newcastle, Australia. Hosted by the University of Newcastle, this human-animal-studies conference brought together scholars from a fascinating array of fields, including animal welfare science and cognition, veterinary ethics and the sociological roles played by animals. Never before, however, have I seen such a diverse conference so united by a single theme.

Dying coral reefs

Peter Harrison, from Australia’s Southern Cross University, for example, gave a chilling lecture about the ongoing loss of our coral reefs. These most biodiverse of all marine ecosystems are home to an estimated one to three million species, including more than a quarter of all marine fish species. However, they serve a planetary function similar to that of the canaries once used in coal mines to warn of the build-up of CO₂ and other lethal gases. Global warming increases oceanic temperatures, killing the symbiotic unicellular algae that live within coral polyps, which then lose their colour, resulting in the reef bleaching. Increased CO₂ dissolution in sea water also acidifies oceans, hindering regeneration.

Reef bleaching significantly accelerated after atmospheric CO₂ concentrations reached 320ppm. Around 30 per cent of all coral reefs have suffered serious damage from bleaching, pollution, fishing, invasive alien species (such as the coral-eating starfish) and disease.

Scientific consensus is that stabilising CO₂ levels above 350ppm will not prevent the catastrophic loss of coral reefs. Levels are at 387ppm and rising, and it is expected that 60 per cent of all coral reefs could be lost by 2030.

Even more important was the keynote lecture by Jennifer Wolch of the University of California, Berkeley – an expert in urbanisation studies and the design of sustainable cities.

Dr Wolch highlighted the devastating environmental costs of our urban lifestyles and, in particular, our dependence on the products of animal agriculture. Her arguments and data, echoed by a host of academics from international institutions, and in lectures throughout the conference, were undeniably compelling.

A momentous lecture was delivered in London by Lester Brown, founder and president of the renowned Earth Policy Institute – an interdisciplinary research organisation based in Washington, DC. Previously the founder of the World Watch Institute, Prof Brown and his team have been monitoring the health of our planetary life support systems for around 30 years (for which he has received 24 honorary degrees, three professorships, and countless international awards). With moving concern, he described the key problems facing humanity.

Demographic changes increasing hunger

Human global population is 6.8 billion, and it is expected to reach nine billion by 2040. Current birth and death rates result in a net 77 million additional people annually, mostly born into developing countries where soils are eroding, water tables are falling and irrigation wells are drying up. Population growth in such countries is outstripping national capacities to increase food supplies, resulting in increasing hunger.

At the same time, around three billion increasingly affluent consumers in the developing world are enthusiastically seeking to emulate the lifestyles of richer countries by consuming more animal products – which require far greater inputs of grain. At the top of this food chain are the US and Canada, where people consume on average 800kg of grain annually (most of it indirectly as beef, pork, poultry, milk and eggs). Near the bottom is India, where people consume less than 200kg each and, therefore, must ingest nearly all of it directly, with little margin for inefficient conversion to animal protein.

Fuelled by such unprecedented increase in demand, world prices of wheat, rice, corn and soya beans roughly tripled from mid-2006 to mid-2008, reaching historic highs. The rise was halted only by the global economic crisis of 2008, but even then prices remained well above historic levels.

Another historically unprecedented trend has been the conversion of grain into biofuels – significantly influenced by the desire of the US to achieve a level of independence from foreign oil supplies. For the first time in history, this has resulted in substantial competition between those buying grain to fuel cars and those buying it to eat.

When the former are buyers in developed countries, and the latter are buyers in the developing world, it is easy to see which group has the most purchasing power.

Inevitably, therefore, hunger is spreading. One of the UN's millennium development goals is to reduce hunger and malnutrition. In the mid-1990s, the number of people in this category was 825 million. It is now more than one billion and rising.

Soil erosion and aquifer depletion

Unfortunately, after decades of increasing food production, our ability to increase yields to meet

ever-rising demands appears to be nearing an end.

Soil erosion is now lowering the productivity of around 30 per cent of the world's cropland. Desertification, caused by overgrazing, overploughing and deforestation, is encroaching on cropland in Saharan Africa, the Middle East, central Asia, and China. Precious topsoils are increasingly lost in vast dust storms in sub-Saharan Africa, northern China, western Mongolia, and central Asia.

To a certain extent, topsoil loss has occurred since the first wheat and barley plantings. The same cannot be said, however, of falling water tables, because the pumping capacity necessary to deplete underground aquifers has developed only in recent decades. Consequently, water tables are now falling in countries that jointly contain half the world's people. As of mid-2009, nearly all the world's major aquifers were being over pumped and wells are starting to go dry. Saudi Arabia, for example, recently announced, because its major aquifer is largely depleted, it will be phasing out wheat production entirely by 2016.

A 2005 World Bank study showed that feeding 175 million people in India was reliant on over-pumping aquifers. In China, this problem affects 130 million people. In total, an estimated 400 million people are being fed by a process that creates overpumping – a situation that is, by definition, unsustainable. As Prof Brown put it: "With aquifers being depleted, this water-based food bubble is about to burst."

Impact of climate change

To these factors must be added the potentially devastating effects of climate change. Since 1970, the Earth's average surface temperature has increased by 0.6°C, and the Intergovernmental Panel on Climate Change projects temperature rises of up to 6°C this century. Yet, for each 1°C rise above the norm, wheat, rice and corn yields decline by 10 per cent.

Additionally, rising temperatures are accelerating global glacial melting. The summer ice melt from Himalayan and Tibetan glaciers sustains the major rivers of India and China during the dry season, together with the irrigation systems that depend on them. China and India, respectively, are the world's top two wheat producers and also dominate world rice harvests. The impacts on world prices when they run out of food will be unprecedented. The melting of the glaciers on which these two countries depend represents the greatest threat to food security that humanity has ever faced.

Unfortunately, this is far from the only threat. The melting of the Greenland and West Antarctic ice sheets (which are terrestrial ice stores), combined with the ocean's thermal expansion, could raise sea levels by up to six feet this century. A mere three-foot rise would devastate the rice harvest of the Mekong Delta, which produces more than half the rice in Vietnam – the world's number two rice exporter. It would also inundate half the rice-land in Bangladesh, home to 160 million people. Hundreds of millions of people depend on the harvests in Asia's rice-growing river deltas and

floodplains. Worst-case scenarios project sea rises as high as 80 feet during the next three centuries, which would fundamentally alter global geography. Much of south-east England and Ireland would be drowned, for example, as would cities along the US eastern seaboard, including Washington and New York.

The livestock connection

We are increasingly aware of the devastating environmental costs of fuelling our economies and lifestyles by burning fossil fuels. Leaders exhort us to fly less, use low-energy vehicles and lighting, insulate our homes and businesses efficiently and to recycle. While each of these measures is necessary and laudable, it is remarkable that little attention has been given to animal agriculture.

Livestock production is the single greatest land user, accounting for 70 per cent of all agricultural land use, and 30 per cent of the Earth's land surface. Expansion of livestock production is a key driver of deforestation, especially in Latin America, where the greatest deforestation is occurring. Seventy per cent of previously forested Amazon land is now occupied by pastures, with feed crops covering a large part of the remainder. About 20 per cent of the world's pastures and rangelands, and 73 per cent of rangelands in dry areas, have been degraded to some degree, mostly through overgrazing, compaction and erosion by livestock.

The greatest effects of our reliance on livestock products, however, are their greenhouse gas emissions (GHGs). These emerged into the global spotlight with the release of a key report by the Food and Agriculture Organisation of the United Nations in 2006: *Livestock's Long Shadow* estimated that 18 per cent of worldwide GHGs, when measured as CO₂ equivalents (CO₂e) – representing 7,516 million tons annually – are attributable to the production of cattle, buffalo, sheep, goats, camels, horses, pigs and poultry. This includes emissions resulting from clearing land to graze livestock and grow feed, the livestock themselves and processing and transporting livestock products. In contrast, all the planes, trains, trucks, cars and other forms of transportation, combined, produce around 13.5 per cent of global GHGs.

The 18 per cent contribution to worldwide GHGs is comprised of CO₂, methane, nitrous oxide and ammonia emissions. The livestock sector is responsible for nine per cent of anthropogenic CO₂ emissions, mostly resulting from deforestation caused by the encroachment of pastures and feedcrops. Additionally, livestock emit 37 per cent of anthropogenic methane – which exerts 72 times the global warming potential (GWP) of CO₂ over a 20-year timeframe, mostly from enteric fermentation by ruminants. They also emit 65 per cent of anthropogenic nitrous oxide – with a staggering 296 times the GWP of CO₂, the great majority of which is released from manure. Finally, they emit 64 per cent of anthropogenic ammonia, which contributes significantly to acid rain and subsequent acidification of the ecosystem.

A study by Goodland and Anhang (November 2009) demonstrated that at least 3,000 million tons of CO₂e attributable to livestock production were misallocated – and at least 22,048 million tons

were entirely uncounted – in *Livestock's Long Shadow*. Uncounted sources included livestock respiration, deforestation and methane underestimates. When these 25,048 million tons are included, the CO₂e attributable to livestock production rises to 32,564 million tons, and the total global inventory of atmospheric GHGs rises from 41,755 to 63,803 million tons. Hence, Goodland and Anhang concluded that livestock production actually accounts for at least 51 per cent of worldwide GHGs, and probably significantly more. They concluded that replacing livestock products with alternatives would be the best strategy for reversing climate change, and would have far more rapid effects on GHG emissions and their atmospheric concentrations than actions to replace fossil fuels with renewable energy sources.

The next article in this series will explore strategies for mitigating the environmental damage created by livestock production.

Key references (others available on request from the editor).

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