SESSION 2 OVERVIEW

Can we feed the world with net zero emissions?

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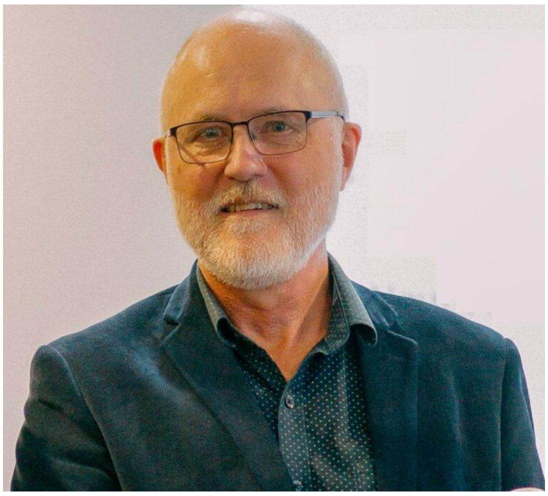

Abstract

Agriculture produces between 12 and 14% of global greenhouse gas (GHG) emissions, excluding transport and processing. While there are options to reduce GHG emissions from agricultural production, food security could also be considered the most legitimate form of GHG emission. The main GHG emissions from agriculture are methane, associated with rice and livestock production, and nitrous oxide associated with nitrogen inputs. Agricultural land can also sequester carbon in soils and trees and, while this is an important contribution, it is perhaps only reversing the land use change disturbance created for agriculture in the first place.

A recent assessment by the Net Zero Australia plan concluded that current reliance by the large industrial emitters on the land sector to provide their offsets are questionable, as agriculture on its own will struggle to meet its stated value chain targets, including insetting all available sequestration. Reducing livestock numbers has often been touted as an overly simplistic solution to reducing agricultural GHG emissions, forgetting that most livestock exist in lower socio-economic regions and are integral to their food security and livelihoods.

Taking a more multi-functional perspective of livestock in subsistence agricultural systems shows that the GHG emissions attributable to meat or milk can be much lower than those of industrial farming systems. Livestock are integral to a largely vegetarian diet in subsistence agricultural systems, without which industrial fertilisers and diesel would be required to produce crops. The production and use of industrial fertilisers contributes approximately 5% of global GHG, but almost half of the world’s population is dependent on industrial nitrogen for their food security. Options are emerging to reduce enteric methane by more than 80% and estimates show that improving nitrogen use efficiency can reduce nitrous oxide emissions by over 50%. However, few of these options are profitable, and even less are relevant to extensive or subsistence agricultural systems. While some agricultural systems can achieve net zero GHG emissions, there are inevitable GHG emissions associated with agricultural production. However, the land use sector also manages significant natural resources and perhaps the future lies in striking a balance between biodiversity and mitigation in a more integrated approach.

Introduction
Agriculture is different from energy or transport. We cannot simply switch off biological processes. Methane from ruminants, nitrous oxide from soils, carbon dioxide from fossil energy use — these are built into the system. So the aim is not *absolute zero* but *net-zero*. That means reducing emissions wherever possible and balancing the rest through sequestration and other strategies.

The Nature of Agricultural Emissions
Globally, agriculture contributes around 12–14 per cent of greenhouse gas emissions. If we include the broader food system—processing, refrigeration, and transport—that share rises to about 26 per cent.

The main culprits are well known:

- Methane, from ruminants and soils.
- Nitrous oxide, from nitrogen inputs.
- Carbon dioxide, mostly from fossil energy inputs.

Because these emissions come from microbial processes, we cannot eliminate them entirely. The challenge is to minimise them and find smart ways to compensate.

The Limits of Sequestration
Sequestration in soils and trees is often presented as the big solution. But it is limited. Soil carbon can be increased with better management, yet it stabilises at a new equilibrium and is heavily influenced by rainfall. Tree planting, as seen in projects like Jigsaw Farms, can deliver neutrality in the short term, but once trees mature, sequestration slows or stops.

Sequestration buys us time — it is breathing space, not a permanent fix.

Livestock, Diets, and Fertilisers: Complex Realities
It is fashionable to target livestock in the climate debate. But reality is more complex. In many developing countries, livestock are essential for food security: they provide manure, traction, milk, and income. Studies even show that some multifunctional systems in Africa have emissions intensities per litre of milk as low as the best dairy farms in the world.

Calls for global vegetarianism overlook affordability and context. Only about 8–16 per cent of the global population can afford to make such choices. Reducing livestock numbers cannot be our central solution.

The same goes for fertilisers. Synthetic nitrogen, made through the Haber-Bosch process, sustains half the world's population. Eliminating it, as Sri Lanka's failed experiment showed, risks food security crises. The better pathway is innovation — for example, on-farm fertiliser production using renewable energy.

Emerging Mitigation Pathways
There are real opportunities emerging, including:

- On-farm renewable energy and biofuels.
- Better manure management in intensive systems.
- Optimised rice cultivation to cut methane.
- Fertiliser inhibitors that can halve nitrous oxide emissions at low cost.
- Feed additives, such as seaweed-based supplements, to reduce methane from cattle.

Taken together, these could reduce emissions by up to 45 per cent. But many remain too costly for extensive or subsistence farming systems.

Economic and Structural Challenges
Most mitigation strategies impose extra costs on farmers without delivering direct returns. Expecting them to shoulder the burden alone is unrealistic. Shared business models are essential. Supply chains, banks, processors — those who set net-zero targets — must be part of the solution.

We also need to be careful with carbon credit schemes. Incentivising tree planting on farmland might look good for offsetting, but it risks undermining food production. The world cannot afford to trade calories for carbon credits.

Balancing Emissions, Biodiversity, and Food Security
Agriculture is about balance. High-input cropping may deliver low emissions per tonne but very little biodiversity. Extensive rangelands may support rich biodiversity but also high methane emissions. A practical future requires trade-offs. We need to think holistically: emissions, biodiversity, and food security must all be weighed together.

Conclusion
Agriculture cannot reach absolute zero emissions. But through smart mitigation, realistic use of sequestration, and shared responsibility across the food system, we can move significantly toward net-zero.

Key messages are clear:

- Mitigation technologies exist, but they require incentives and cost-sharing.
- Sequestration is useful but temporary.
- Fertilisers and livestock are essential to food security and cannot simply be abandoned.
- Food production must not be sacrificed for carbon offset schemes.
- Trade-offs are inevitable, and balance is essential.

Ultimately, agricultural emissions are the most legitimate form of emissions, because they are inseparable from the task of feeding humanity. The challenge is not to erase them, but to manage them responsibly while sustaining food for a growing world.

Richard's research focuses on carbon farming and accounting towards carbon-neutral agriculture and options for agriculture to respond to a changing climate. He has developed the first greenhouse gas accounting tools for all sectors of agriculture in Australia, which now form an agreed national standard for agriculture.

Richard is a science advisor to the Victorian, Australian, New Zealand, UK and EU governments, the International Livestock Research Institute and the UN Food and Agriculture Organization on climate change adaptation, mitigation and policy development in agriculture.

Richard was recently named on the Reuters list of the world's 1,000 most influential climate scientists.