

Land sector accounting and the national carbon accounting system

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Australia's *National Carbon Accounting System* (NCAS) is a world-leading system that accounts for greenhouse gas emissions from land based sectors. Land based emissions (sources) and removals (sinks) of greenhouse gases form a major part of Australia's emissions profile. Around 27 per cent of Australia's human-induced greenhouse gas emissions come from activities such as livestock and crop production, land clearing and forestry operations. Land management activities including soil preparation, fertiliser use, harvesting and burning all affect emissions of greenhouse gases. A significant proportion of Australia's land based emissions occur as non-carbon dioxide gases, in particular methane from livestock production and nitrous oxide from fertiliser application. Actively growing forest systems sequester carbon from the atmosphere through the process of photosynthesis, and increasing forest cover acts as a long-term carbon sink by storing carbon in the trees, debris and soils. In 2006, removals associated with reforestation activities were estimated to be approximately 23 Mt of carbon dioxide (based on forests planted since 1990), effectively reducing national emissions by around 4 per cent.

Land sector accounting

Accurate accounting of the emissions and removals of greenhouse gases from the land sector requires knowledge of the carbon cycle (for carbon dioxide and methane emissions) and the nitrogen cycle (for nitrous oxide emissions). The growth and life cycles of forests and agricultural crops, climate, soils, land cover change and land management are all important components of a comprehensive land sector emissions accounting system.

The NCAS accounts for these factors through an integrated, spatially explicit system that combines:

- thousands of satellite images to monitor land use and land use change across Australia since 1972,
- monthly maps of climate information, such as rainfall, temperature and humidity,
- maps of soil type and soil carbon,
- databases containing information on species characteristics, land management, and changes in land management over time, and
- spatial and temporal ecosystem modeling (the Full Carbon Accounting Model (FullCAM)).

Nitrous Oxide and Methane in Land Systems

Non-carbon dioxide greenhouse gas emissions from soil are dominated by nitrous oxide and represent the second largest source of emissions from the land sector, after methane production from livestock. Soils are also a source of methane emissions, associated mainly with the anaerobic conditions found in waterlogged soils such as rice production systems and with manure decomposition. Methane may also be taken up in some agricultural and forest soils, providing a small but potentially important greenhouse sink.

Nitrous oxide

Nitrous oxide is produced in soils as a natural part of the nitrogen cycle, and is released to the atmosphere as part of the microbial decomposition of ammonium to nitrate. This process is known as *nitrification*. Nitrous oxide is also released through the opposite process, *denitrification*, where nitrate is converted to nitrite and dinitrogen.

Direct emissions of nitrous oxide from soils result from the use of nitrogenous fertilisers, animal urine and manure, nitrogen fixing plants, and the decomposition of plant residues.