



Science
Societies

Research Update: Better Emissions Estimates for Manure

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Cattle graze in a communal pasture during the dry season near Kapenguria, Kenya. Photo by David Pelster.

Back in 2021, we told you about a new global database of parameters related to livestock manure and the greenhouse gases it emits (see <https://doi.org/10.1002/csan.20450>). At that time, a New Zealand-based team reported in the Journal of Environmental Quality (JEQ) on the launch of the first part of the ambitious project, a “field database” cataloging characteristics related to manure applied to land and deposited by grazing livestock (<https://doi.org/10.1002/jeq2.20186>). Two additional databases, covering the housing and storage phases of manure management, were in the works. Dubbed DATAMAN, the project’s main goal was to improve the quality and quantity of data on livestock manure worldwide so that scientists and policymakers could better estimate the nitrous oxide (N₂O), methane (CH₄), and ammonia (NH₃) emissions and, in turn, better identify and test mitigation strategies.

As the research team recently reported in a follow-up JEQ article (<https://doi.org/10.1002/jeq2.20430>), the housing and storage databases are now complete. Together, the database trio contains more than 8,000 emission factors compiled from 686 studies and includes statistics on emission factors, manure characteristics, soil properties, climatic conditions, and numerous other variables.

The information is very valuable: About one quarter of global greenhouse gas emissions come from agriculture, forestry, and land use. For agricultural sources, according to the DATAMAN website, livestock manure contributes 30 to 50% to global nitrous oxide (N₂O) emissions (where NH₃ is an indirect source of N₂O) and 10 to 40% of total agricultural CH₄ emissions for most countries.

Improved Estimates for More Accurate Inventories

Countries participating in the Paris Agreement on climate change report their estimated greenhouse gas emissions to the United Nations Framework Convention on Climate Change. Methodologies for creating these estimates are spelled out by the Intergovernmental Panel on Climate Change, which offers a tiered set of approaches of increasing accuracy. But the higher tiers require better data, so many data-challenged countries provide estimates using the serviceable, but least refined, methodology.

A key vision of DATAMAN, according to the researcher leading the effort, is to move those countries up a tier or two. Soil scientist Tony van der Weerden says the improved estimates will ultimately lead to more accurate greenhouse gas inventories and better understanding of mitigation options.

“There’s huge value to be gained from analyzing large datasets that contain a wide range of soil, climatic, and management conditions,” says van der Weerden, a senior scientist at New Zealand’s AgResearch, a national institute for agricultural science and research. “It gives researchers the opportunity to identify key drivers, some of which we can influence.” Scientists Encouraged to Contribute Their Data DATAMAN, a play on the words “data” and “management,” is available for free to scientists and policymakers who register on the site. The data can be sliced, diced, and downloaded to suit the user’s objectives. For example, van der Weerden and his co-authors published another article in JEQ (<https://doi.org/10.1002/jeq2.20259>), based on information from DATAMAN’s field database, on ammonia and nitrous oxide emission factors. Although all three databases are now available, holes remain. There are relatively few entries for Africa and South America, for example. Much of the database was populated by a team of researchers from an exhaustive literature review. Now van

der Weerden is encouraging fellow scientists to contribute their own data to make DATAMAN a more robust, up-to-date resource.

For scientists examining areas of the world underrepresented in the database, DATAMAN can still be useful, van der Weerden points out. Researchers can filter data according to the soil properties, climatic conditions, and other variables to approximate emission factors for their own area. “We already see DATAMAN as a valuable resource for researchers and policymakers,” says van der Weerden, “and this value will only increase through its continued expansion.

DIG DEEPER

Read the original CSA News article “New Global Greenhouse Gas Database Available for Interrogation,” about the first in the DATAMAN series of articles, here: <https://doi.org/10.1002/csan.20450>

Read the most recent (2022) article in the DATAMAN series from the Journal of Environmental Quality, “DATAMAN: A Global Database of Methane, Nitrous Oxide, and Ammonia Emission Factors for Livestock Housing and Outdoor Storage of Manure,” here: <https://doi.org/10.1002/jeq2.20430>

Read the first (2020) article in the DATAMAN series from the Journal of Environmental Quality, “DATAMAN: A Global Database of Nitrous Oxide and Ammonia Emission Factors for Excreta Deposited by Livestock and Land-Applied Manure,” here: <https://doi.org/10.1002/jeq2.20186>

Read a Journal of Environmental Quality article analyzing the DATAMAN-field

database here: <https://doi.org/10.1002/jeq2.20259>

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