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Communicating the Uncertainty in Greenhouse Gas Emissions from Agriculture

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Effective communication of the uncertainty in estimates of greenhouse gas emissions is important. It allows an individual, whether they are a scientist, policy maker or member of the public, to draw proper conclusions and so make sound decisions. Communicating uncertainty is challenging, however. There is no single best method for communicating uncertainty and the success of a particular method will depend on the subject matter and the target audience.

Our interest is in communicating the uncertainty in estimates of greenhouse gas emissions from agriculture to those who might directly use the results from a national inventory. We tested six methods of communication. These were: calibrated phrases such as 'very uncertain' and 'likely'; probabilities, whereby the probability of being within a defined range of values is given; confidence intervals for the expected value; histograms; box plots and shaded arrays. We asked 64 individuals who use results from the greenhouse gas inventory for their opinions on how successfully these methods communicated uncertainty. We analysed the results to see which methods were preferred and to see whether this preference was affected either by the professional group to which individuals belonged or the level of mathematics to which they were educated. The professional groups represented in our study were categorised as (i) those who influence policy (ii) research scientists (iii) those representing the environment and (iv) those representing the agricultural industry.

The responses to our questionnaire were varied but some clear messages came through. Our analysis showed that although calibrated phrases were thought to be a good method of communication they did not convey enough information and were open to misinterpretation. Shaded arrays were similarly criticized for being open to misinterpretation, but proved to give the best indication of uncertainty when individuals were asked to interpret results from the greenhouse gas inventory. Box plots were favoured by a majority of our participants but this result was driven by those with a better understanding of maths.

We concluded that the methods chosen to communicate uncertainty in greenhouse gas emissions should be influenced by professional and mathematical background of the end-user. We propose that boxplots annotated with summary statistics such as mean, median, 2.5th and 97.5th percentiles provide a sound method for communicating uncertainty to research scientists as these individuals tend to be familiar with these methods. End-users from other groups may not be so familiar with these methods and so a combination of intuitive methods such as calibrated phrases and shaded arrays with numerate methods would be better suited. Ideally these individuals should be presented with the intuitive qualitative methods with the option to consider a more quantitative description, perhaps presented in an appendix.