

A Universal protocol for farm scale auditing of soil carbon

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One way for landholders, and more generally for agriculture to participate collectively in the carbon economy, and contribute to national greenhouse gas inventory programs is to devise efficient approaches to audit the on-farm soil organic carbon (SOC) stocks. Design-based soil sampling is recommended as an appropriate method for unbiased estimation soil carbon stocks — in terms of per unit area (of a farm) — with sufficient statistical confidence. To improve the efficiency of design-based sampling such as through stratified random sampling, relevant prior information such as existing soil carbon mapping is required. Naturally, not all landholdings will have this type of prior information. However, it is possible to resolve this obvious barrier through the use of a spatial downscaling (or disaggregation) of nationally calibrated SOC models to derive relevant farm scale prior information of soil carbon variability. Coupled in with the spatial downscaling is a stratification and sampling algorithm (ospats) that can be optimized on the basis of expected financial gain in consideration of the costs (of sampling) and of the certainty associated with the prior information. Effectively, with this protocol any landholder will be able to derive relevant farm scale mapping of soil carbon, that will in turn be used as input into ospats to provide recommendation of how many samples should be collected and where they should be collected from for an unbiased soil carbon audit. Implementation of this protocol would be instigated for establishment of baseline stocks, and then repeated for ongoing audits through time. Case studies from both Australia and New Zealand illustrate the implementation of this carbon auditing approach.