

Sampling for mapping and monitoring of soil carbon stocks

Dick J. Brus*
dick.brus@wur.nl

Martin Knotters*
martin.knotters@wur.nl

*) Alterra, Soil Science Centre, Wageningen University and Research Centre, P.O. Box 47, 6700 AA Wageningen, The Netherlands

An important step in mapping and monitoring of soil carbon stocks or changes therein is sampling, i.e. the selection of locations and times on which observations are taken. Integrated planning of data collection and data processing, with respect to the required information, is crucial for efficient mapping and monitoring. Our aim is to contribute to the discussion on sampling aspects of mapping and monitoring of carbon stocks, and on sampling for validation of maps.

We distinguish two modes of selecting parts from a universe/target population: targeted (or purposive) sampling and probability (or random) sampling. If local predictions are required, i.e. mapping, then purposive sampling striving for fair spatial distribution of the sampling units is recommendable. Next, a model of spatial variation is used to interpolate to unvisited locations. If global information such as areal means, totals or proportions are required, then probability sampling is attractive. Probability sampling is recommendable if objectivity is important, because model-free estimates can be obtained. Objectivity is important in testing against (legal) standards and in validation (quality assessment). The choice for a type of design for probability sampling (e.g. stratified simple random sampling, two-stage random sampling) depends on the required information, constraints on its accuracy and on practical and budgetary constraints.

In monitoring several patterns for sampling in space and time can be applied, such as static samples, synchronous samples, rotational samples *et cetera*. Furthermore, four combinations of sampling modes (targeted or probability) in space and time are possible. For estimation of temporal trends in spatial means we recommend to combine probability sampling in space with targeted selection of sampling times, and to revisit at least a part of the sampling locations. We stress that taking conscious decisions on the sampling design is essential for the success of monitoring programmes for soil carbon stocks.