OPINION:

APPLY MORAN'S I –
A TOOL TO HANDLE SPATIAL HETEROGENEITY IN GEOECOLOGY –
AN EXAMPLE OF SOIL CARBON INVENTORY IN A BEECH FOREST

MORAN'S I ALS WERKZEUG ZUM UMGANG
MIT RÄUMLICHER HETEROGENITÄT IN DER GEOÖKOLOGIE –
AM BEISPIEL BODENKOHLENSTOFFINVENTARISIERUNG
IN EINEM BUCHENWALD

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SUMMARY

The understanding of mass transfer processes between the soil and other compartments of the Earth system profits from improved practices in soil inventory. The main obstacle to solid soil inventories of any biogeochemical element is its high spatial heterogeneity. As the number of samples is limited to the possible, agreements on the minimum numbers of samples for individual landscape ecosystems are needed. Here, we provide (a) empirical evidence that increasing the area of the single sample can help to reduce the number of samples needed for an ecosystem inventory and (b) a new modelling guidance to optimize biogeochemical soil inventories. For a typical beech forest ecosystem of Central Europe, we performed two different soil carbon inventories of the uppermost 5 cm gaining the same soil volume but from different individual samples sizes. The results were used to define autocorrelation with Moran's I and to construct realistic model forests of varying autocorrelation. For all possible autocorrelated soil carbon scenarios mean and variation of a big sample (n= 5) and a small sample strategy (n= 25 and N= 125) was calculated. For the real forest the mean value for carbon stocks did not differ, but model approach showed the limits reducing sample number by increasing sample size. In summary, our exercise demonstrates the possibility of optimized soil inventories provided that expectable Moran's I distributions are known for individual ecosystems.

Keywords: Sampling startegies, soil carbon distribution, Moran's I, Best practices for soil sampling, Soil carbon heterogeneity