



## Approach of regionalisation c-stocks in forest soils on a national level

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### Introduction

In December 2006, the German government decided to manage forests as carbon sinks to reduce greenhouse gas emissions in accordance with Article 3.4 of the Kyoto Protocol. The National Forest Monitoring data contribute to the fulfilment of these reporting commitments.

In Germany, National Forest Monitoring includes the systematical extensive National Soil Condition Survey (BZE) and the detailed case studies (Level-II) which determine the processes within forests. This complex monitoring system is appropriate to Germany's greenhouse gas reporting (THG 2008 to 2012). The representative BZE plots can be used to obtain regional data for the National Carbon Stock Inventory. Here, an approach adopting a combination of geostatistics and regression analysis is preferred. The difficulty of showing the statistical significance of expected small changes while carbon stocks are generally high is one of the major challenges in carbon stock monitoring. However, through intensive preparation and cooperation with the forestry authorities of each federal state, the errors incurred in determining changes in carbon stocks in forest soils, which must be stipulated in greenhouse gas monitoring, could be minimised. In contrast to the detailed soil case studies, in which essentially the sources of error occur repeatedly in carbon stock change calculations, the BZE data can be stratified to form plots with homogenous properties, thereby reducing the standard error of estimate. Subsequently, the results of the stratification are projected across Germany, the reporting unit for greenhouse gas monitoring.

### National Forest Monitoring

The BZE represents a national, systematic sampling inventory of the condition of forest soils. The first BZE inventory (BZE I: 1987 to 1993) was carried out on a systematic 8 x 8 km grid on the same sampling plots adopted in the Forest Condition Survey (WZE). In some areas the network of sampling plots involves 1900 grid points. The first BZE I survey was repeated after 15 years, between 2006 and 2008, by the national and the state authorities in cooperation. Afterwards, extensive laboratory and statistical analyses were conducted. Necessary parameters are listed in table 1.

### Upscaling approach

There are different approaches for presenting extensive carbon stock data (Baritz et al., 2006). The availability of georeference plots means one can merge the point data with map data. In Germany, an approach was tested that used homogenous soil areas and plot-information from the national soil inventory. For every soil area c-stocks were regionalised. Only information from BZE-plots were involved which were characteristic for the soil area. The indicators were soil type and substrate class. For every soil area the forest areas were taken in account to calculate c-stock per forest area. The sum of every c-stock per soil area is the c-stock in forest soils of Germany.

Tab.1: List of parameters for the carbon inventory (BZE II)

#### Components Parameters

##### Point level

Field sampling Width of depth classes, Fine roots, humus (< 2 cm), dry bulk density, stone content, area of humus layer sampled, height a.s.l., litterfall, deadwood (from 10 cm)

Analysis C content, fine soil fraction, weight of humus layer, Carbon stock calculations Carbon stock

##### Regional Level

Plot Soil type, parent material, vegetation type or forest

Regionalisation Soil and land use maps, statistical models, ecological regions, digital elevation models, climate regions