

BioSoil: Benchmark site selection

Nathalie Cools and Jari Mikkelsen, FSCC

Introduction

Benchmark sites are sites where, besides of the samples taken in the demonstration project, also the old stored soil samples of the first pan European forest soil survey will be analysed. The benchmark sites make up 10 % - 15 % of the total number of plots, ideally equally spread over Europe.

At the Kick-off meeting of BioSoil FSCC was asked to set up a list of criteria for the selection of the benchmark sites. This task was more complicated than it seemed at first. The selection of the benchmark sites depends on the aim of the use of these data. One important aim is quality. By analysing one subset by a central laboratory, this subset will produce comparable data across Europe. Individual countries- or the central data management facility - will then be able to compare the results of one sample analysed in the national and in the central laboratory and therefore obtain an idea in how far the national results deviate from the central dataset.

A second application could be the comparison with the samples taken 10 years ago during the previous survey. This comparison could then provide information on changes in the European forest soils in function of time. To be able to draw general conclusions, it would be important that the selected benchmark sites are representative for Europe. This is however impossible with the current dataset. Previous studies show that a 16x16 km² grid is the maximum grid size to guarantee representativity across Europe. When 10-15% of the plots are selected, the representativity is lost, even when the selection is completely randomised.

This will force us to use a more pragmatic approach. See below.

Selection criteria

The selection criteria depend largely on the history of the plot. The sampling plots of BioSoil are located on the systematic 16 x 16 km² grid which has been established for the annual crown assessment for tree vitality within the ICP Forests programme. On this grid a first pan European forest soil survey was conducted between 1989 and 1997.

For the selection of these benchmark sites, the following guidelines must be taken into account:

1. A first condition is that during the two surveys soil samples have been taken on exactly the same plot, which means that plot number and the coordinates of the plot should be exactly the same.
2. The second condition is that the soil samples from the first survey should have been stored and enough material should still be available for reanalysis. Some countries informed us that they have stored all soil samples but will have not more than 30 g of soil available for reanalysis by a central laboratory. But, overall it was agreed that the size of the samples should be 50 g for the organic layer and 100 g for the mineral layers (0-10 cm, 10-20cm, 20-40 cm, 40-80 cm).

3. Sampling is done according to fixed depths. Therefore a third condition is that the samples of the first survey should have been taken according to fixed depths as well (mandatory: organic layer, 0-10 cm, 10-20 cm, and optional: 20-40 cm, 40-80 cm)

4. In the BioSoil demonstration project the number of subsamples per sampling plot should be at least five but more subsamples are allowed. In the first survey the number of subsamples differed greatly from country to country. On some plots, the bulked soil sample covered better the within plot variation than in other plots. The plots where at least five subsamples have been taken should receive higher priority to be selected as benchmark sites.

5. A fifth criterion is the absence of major disturbances which might have had a clear influence on the chemical or physical soil parameters such as harvesting by heavy machinery in the past few years, clear cut, disposal area of e.g. dredging material

For those countries that

- 1) did not store soil samples of the first survey or
- 2) did not participate in the first soil survey or
- 3) still have more than 10 – 15% of their plots fulfilling the criteria listed above

the selection of the benchmark sites should be based on the representativity of the major forest soil types.

FSCC suggests to apply our understanding of the **soil forming factors** which are 1) parent material 2) topography 3) climate 4) biota and 5) time. The selection of the benchmark sites should try to cover the most representative combination of these five factors in your country. Two additional factors to this list are 6) hydrology and 7) human influence. The factor 'biota' refers in our case to the forest ecosystem. This can be further differentiated in for example evergreen, deciduous and mixed forest or more detailed when relevant e.g. the application of the forest type classification. Additionally it might be linked to the information obtained from the Biodiversity component of BioSoil.

Example for Flanders

e.g. In Flanders there are 10 16x16 km² level I plots. Two benchmark sites will have to be selected. Soil samples of the first survey have not been stored. The parent material of most of the Flemish forest soils are 'cover sands' and 'loess blankets' which were deposited during the Pleistocene Ice Ages. The major landform in Flanders is level land (river plains - lowlands), climate is more or less homogeneous, forest types are usually evergreen on the cover sands and deciduous on the loess soils, and the age of all soils is younger than 40,000 years. The human influence is prominent in most of the Flemish forest soils.

Of the 10 plots, 5 are sandy soils on the cover sands, 2 are loess soils, 1 in the old river sand of the Maas river, 1 in a recent alluvial plain, 1 in Tertiary sands facing the surface in one particular area in Flanders. This means that in Flanders the parent material is an important differentiating factor. Therefore we should select a site on a sandy soil of the Campine region (cover sands) and one site on a loamy soil in Middle Belgium (loess blankets).

An important difference between the two loess soils is the human disturbance. In one profile the original Ah-E-B is conserved. In the other one the original Ah and E have been disturbed by ploughing. On both plots the major tree species is Oak.

Of the 5 sandy plots, three profiles are irregular and disturbed by human influence. Because the human disturbances can vary largely on short distances, we prefer in both cases the least disturbed profile of which we suppose it will better represent the soil situation on similar plots in Flanders. So Flanders would select 'Beerse' and 'Binkom-Lubbeek' as the two benchmark sites for Flanders.