

Pilot study on harmonising National Forest Inventories in Europe



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The 'Pilot study on harmonising National Forest Inventories in Europe' is a contract study of the Joint Research Centre (JRC) of the European Commission. The two years study was financed by the EC Forest Focus scheme and started in December 2006 and ended in December 2008. The study was coordinated and conducted by the Institute for World Forestry (University of Hamburg) in cooperation with the following three partner: Dipartimento di Scienze e Tecnologie Ambientali Forestali (DISTAF), Centre de Recerca Ecològica i Aplicacions Forestals (CREAF) and the European Forest Institute (EFI). The final technical report of the study will be available in February/March 2009.

The objective of the "Pilot study on harmonising National Forest Inventories in Europe" was to test and evaluate different technical approaches to harmonise the NFI variables *forest area*, *forest types* and *diameter distribution*. **Four proposed approaches** were tested with real data for selected test sites in three different countries, namely Germany, Spain and Italy. For each of the three countries two test sites were selected, which represent different forest ecosystems but also most typical forests landscapes of the countries.

Within **Approach 1** Landsat data were used in combination with terrestrial NFI data to produce "coarse" forest area maps. In a next step the main attributes used in defining forest area (*minimum width*, *minimum area* and *minimum crown coverage*) were evaluated on sub-plots using high resolution DOP data. Based on the resulting high resolution sub-samples, the forest area is re-calculated from the new classified datasets (forest/non-forest). Regression models were built between forest area from the low resolution data and the forest area from the high resolution data. The whole forest area estimated from the low resolution data was finally calibrated with the resulting regression coefficient. Based on different selected national definition thresholds and the international definition of FAO, harmonised forest cover data were produced for two selected test areas, namely Germany Saxony and Spain Pyrenees. The results of the two test sites clearly demonstrate that the proposed methodology effectively harmonises the NFI variable 'forest area' according to international reference standards such as of the FAO. The results show that differences between national definitions and/or international reference standards (see FAO) lead to differences in forest area estimation between 1-3%.

Linking NFIs with EC Forest Focus/ICP Forests assessments is another option to harmonise NFI data according to international reference definitions. The objective of **Approach 2** was to calibrate NFI forest type information to an international standard by using EC Forest Focus/ICP Level I data as an additional reference value. Forest type in this study was classified as *predominantly broadleaved*, *predominantly coniferous* and *mixed forests*. The concept of the method was based on the classification of Landsat data by applying *tree species* data from NFI and Level I respectively. Data were used as training data to produce forest type maps for two different standards: national standard (based on NFI) and international standard (using Level I as a sub-sampling of NFI). The pilot study shows that at test site level different factors were limiting the feasibility of this approach. The main obstacles, which hindered a successful implementation of the approach, were a) the low number of Level I plots per test site, b) the kNN classification inaccuracies and c) the usage of categorical classes instead of metrical data. Most critical for the applicability of the harmonisation Approach 2 was the low number of Level I plots at test site level.

The primary objective of **Approach 3** was to develop and test two different technical approaches to harmonise NFI data on forest types by a) using CLC2000 definitions as a reference standard or b) using CLC2000 as an already harmonised data input for NFI based forest type mapping. The CLC project was chosen as it represents an important harmonised already available European reference dataset and methodology for land use/land cover analysis. Like in Approach 2, forest type was classified as *predominantly broadleaved*, *predominantly coniferous* and *mixed forests*. In Approach 3A obtained figures on forest types were provided in tabular format only. Data were basically obtained by re-classifying NFI plot data according to CLC reference standards and the applied threshold of 75 % for discriminating forest types. In Approach 3B instead, NFI data were re-classified according to the CLC definition like in Approach 3A, but are also used to produce forest type maps by remote-sensing image classification. Especially the map-based approach offered new opportunities to detect forest types status and changes by combing NFI field data with CLC standards and remote sensing data. The approach seems especially applicable for large scale assessments.

Forests can be characterised also by their DBH distributions, which is a core variable to assess other core variables like growing stock and carbon stock. As most NFIs in Europe apply different thresholds for DBH assessments, it is crucial to have harmonised and reliable estimates of the number and size of trees below a certain applied threshold. This counts especially for the reporting on the UNFCCC Kyoto Protocol. The primary objective of **Approach 4** was to derive diameter distribution models for main tree species for each test site, taking into account specific DBH thresholds as they could theoretically be defined by international standards. In addition to these DBH distribution models, differences in percentage were calculated comparing the estimated diameter distribution with observed diameter distribution. The Weibull and the Negative Exponential function provided highest goodness-of fit for DBH data. In addition to the distribution modelling, the contribution of DBH classes below the defined threshold to the estimates on total growing stock and total carbon stock were evaluated. Results show that the contribution of lower DBH classes (0-11 cm) affects only 2-5 % of the total growing or carbon stock. The results show also that the approach can be applied relative easily to any NFI dataset, thus allowing harmonising DBH data to any DBH threshold across Europe.