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Demonstratieproject Biosoil - biodiversiteit in de internationale proef-vlakken van het bosvitaliteitsmeetnet

Forest Focus - Biosoil Demonstration Project / Level I Forest Biodiversity Module

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Bijlage 4 Biosoil forest Biodiversity field manual

FOREST FOCUS DEMONSTRATION PROJECT BIOSOIL 2004-2005

BIOSOIL FOREST BIODIVERSITY FIELD MANUAL

(SYNTHESE VAN VERSIE 1.0/1.1/1.1A 2006-07)

Elaborated by:

Working Group on Forest Biodiversity

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INTRODUCTION

The intention of the Forest Focus Regulation (EC) N° 2152/2003 is to broaden the scope of the monitoring scheme from the protection of forests against atmospheric pollution and forest fires towards other environmental issues such as soils and forest biodiversity. Article 6 of the basic act allows the Commission as well as the Member States to carry out studies and demonstration projects for this purpose. The BioSoil project is such a study, which aims to carry out an inventory of soil chemical characteristics and forest biodiversity at the Level 1 plots. This paper concentrates on the forest biodiversity component of BioSoil. The approach outlined was devised following meetings of biodiversity experts from the Member States combined with field testing of the approach and in co-operation with the Joint Research Centre of the European Commission.

Many initiatives are currently taken to estimate the loss of biodiversity in Europe. Efforts to develop guidelines for assessing forest biodiversity have been under way for many years. Several processes like the MCPFE process (Vienna, 2003) and the Convention on Biological Diversity are presenting lists of indicators relevant to forest biodiversity. However, there is still a need to select and test simple and suitable indicators to measure and describe forest biodiversity at stand as well as at European level and there is still no large scale monitoring system of forest biodiversity in Europe. The existing Level 1 survey of the monitoring programme represents an option for such a large scale monitoring system. The Level 1 survey is a systematic network based on a 16km x 16km trans-national grid of sample plots and as such represents a statistically unbiased sampling tool for European forests. It should also be stressed that the Level 1 survey does not aim and has not been designed to be a comprehensive forest biodiversity survey, but represents a unique opportunity to examine selected parameters of biological interest in forests at the European level.
The BioSoil initiative represents this opportunity to assess and demonstrate the efficacy of the Level 1 network, as a representative tool of European forests and to address other issues of relevance to European forestry such as forest biodiversity with the addition of a few assessment variables. The approach adopted is known as the stand structure approach, which assumes an increased potential for biological diversity with increasing

complexity of the forest stand. This approach is complemented with the addition of biological data such as information on the ground vegetation community.

BIODIVERSITY OBJECTIVES OF BIOSOIL

The overall objectives of the biodiversity component of BioSoil are to make an inventory of components of forest biodiversity such as forest structure and species diversity using the Level I systematic network.

The BioSoil project will provide data to support both international and national policy on forest biodiversity, by:

- Conducting a **demonstration study** to collect harmonised information relevant to forest biodiversity at the European level and demonstrate the use of the Level 1 network in this context;
- Presenting a European forest type classification of the Level 1 plots and **provide a first attempt at habitat classification** of the forests of Europe;
- Testing selected internationally recognised, robust and practical indicators of forest biodiversity on a large scale survey thereby to develop a practical methodology as a manual;
- Establishing an improved common baseline framework to integrate other information and ongoing projects (including the soil initiative of BioSoil) on forest biodiversity to achieve maximum added value;
- Designing a multi-scale hierarchical approach to quantify European forest biodiversity and monitor changes over time and space;

BIOSOIL SAMPLING APPROACH

The sampling approach of the biodiversity component of BioSoil includes the following surveys;

- Plot design:
    - BioSoil sampling plot design
    - Geo-referencing of the plot using a common projection
- Forest type classification
    - Verification of actual forest type
- Structural forest diversity
    - Diameter at breast height and species composition of all woody plants (including standing and lying trees, living and dead))
    - Coarse woody debris, snags, and stumps
    - Canopy closure and tree layering
- Compositional forest diversity
    - Ground vegetation (vascular plant species list)

THE BIOSOIL BIODIVERSITY FIELD MANUAL

INTRODUCTION

The manual of crown condition assessment gives detailed instructions of crown condition plot establishment and operation. Despite this, although annual surveys of crown condition are conducted at the Level 1 sampling points across Europe, different countries may operate different sampling configurations of the crown condition sample trees. This leaves many countries operating at a point sample level rather than at a plot sample level of known and fixed area.

For the purposes of this demonstration project on BioSoil biodiversity, components of forest biodiversity will be sampled across a known plot of fixed area with the plot location being related to the location of the crown condition survey and to the soil pit of the soil survey of BioSoil.

BIOSOIL PLOT INSTALLATION

The basic BioSoil plot is devised as a circular plot with a radius of 25.24 m (2000 m^2) divided into three circular subplots: an outer subplot (subplot 3) with a radius of 25.24 m (2000 m^2) and including 2 inner circular subplots with fixed radii of 3.09 m (30 m^2, subplot 1) and 11.28 m (400 m^2, subplot 2), see Figure 1.

It is recommended that the BioSoil sampling plot is located in relation to the location of the crown condition assessment and the soil pit of the soil component of the BioSoil project in such way that the soil pit should be within the 2000 m^2, but where possible outside the boundaries of the subplots 1 and 2.

The ground vegetation, forest deadwood surveys, and canopy characteristics, are conducted in the BioSoil subplots 1 and 2 only.

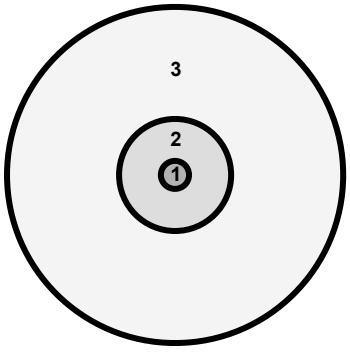


Figure 1. The basic BioSoil plot**. Coarse woody debris, snags, stumps, ground vegetation and canopy characteristics are measured in the BioSoil subplots 1 and 2 (a total sampling area of 400 m^2). Tree species and DBH (diameter at breast height 130 cm) are recorded across the entire BioSoil plot.**

Slope correction
Where the BioSoil plot occurs on steep slopes, slope correction factors must be used.

Clarification:
For plots on flat ground, the radius proposed above can be used. Where the BioSoil plots occur on steep slopes, the plot's radius varies, depending on the steepness of the hill, and the plot becomes oval in shape, not circular. The radius of a plot that occurs on sloping ground must be adjusted using trigonometry (secants) or as done by most foresters by using a slope correction table. The slope of the plot can also be measured using a clinometer.

METHOD OF ESTABLISHMENT OF THE PLOT
It is important to record the exact centre of the plot. This can be done by registration with GPS coordinates, complemented by simple maps and azimuth along with distance assessments to allow for a precise location of the plot. The plot centre is marked using e.g. a metallic bar (inert material is recommended) driven into the ground, (down to the surface of the forest floor in order not to disturb works or traffic in the forest). The georeferencing is mandatory to the project, using GPS registration whenever possible.

It is also recommended to draw simple diagrams, and to take photos of the plot to assist possible future plot relocation. The diagrams should include several identifiable elements (road, large tree, rivulet, etc) to help to find the plot again if the GPS registration has not been satisfactory or if the metal pin has disappeared.

Also if there are clear features and characteristics of the plot which may help in the evaluation of the data such as big rocks, rivulets, trails, forest edges, changes in plant communities, it is recommended to make a sketch of these features.

Table 2. **The basic BioSoil circular plot of 25.24 m radius consists of 3 subplots of different radii.**

Unit	Shape	Radius*/(area)
Subplot (1)	Circle	3.09 m (30 m^2)
Subplot (2)	Circle	11.28 m (400 m^2)
Subplot (3)	Circle	25.24 m (2000 m^2)

*distance from the centre of the plot.

GEO-REFERENCING OF THE PLOT CENTRE AND OF THE SOIL PIT(S)

The geographic location of the BioSoil plot centre is determined using a GPS receiver. All GPS readings must be differentially corrected to yield an accurate position and elevation. The location of the soil pit must also be geo-referenced.

The BioSoil plot location must be geo-referenced using a common European projection. The ETRS89 Lambert Azimuthal Equal Area Coordinate Reference System (ETRS-LAEA) is recommended being the geodetic datum for pan-European spatial data collection, storage and analysis (Annoni *et al*., 2003). If another system is used, it is mandatory to submit datum and projection in order to make a conversion to ETRS-LAEA possible by the European Commission.

METHOD

The GPS coordinates are read using the GPS equipment and are noted on the forms **without** decimals. For an exact assessment of the coordinates in the centre of the plot at least 10 (preferably 30) data values from contact with at least 4 satellites (ideally 5-7 satellites) must be read (time 1-3 minutes). If the satellites are too close to each other, the measurement is imprecise. The mean of the coordinate measurement is written in the data form and eventually also on the simple drawing together with the UTM zone and a code for the accuracy of the estimate of the location.

In the event that the plot centre cannot be located, (*i.e.* poor quality or no signal), the GPS can be registered at another point where signals may be received. The distance and azimuth from this point to the plot centre can be measured and thus the plot centre can be located.

BIOSOIL PLOT ASSESSMENTS AND MEASUREMENTS	Subplot 1 30 m^2	Subplot 2 400 m^2	Subplot 3 2000 m^2
General plot description	Yes		
Check of the European forest type classification	Yes		
DBH and species of all woody plants taller than 130 cm (standing and lying, living and dead)	All trees DBH > **0** cm (taller than **130** cm)	All trees DBH ≥ **10** cm	Only trees DBH ≥ **50** cm
Top height and bottom of canopy layer	Selection of minimum 3 trees		
Coarse woody debris, snags, and stumps	D > **10 cm**	D > **10 cm**	No
Canopy closure (visual)	Yes	Yes	No
Tree layering (visual)	Yes	Yes	No
Ground vegetation – vascular species list only	Yes	Yes	No

Table 3. Mandatory minimum measurement in the BioSoil Plot. **Tree species and DBH of standing and lying, living and dead trees (H >130 cm) are recorded across the entire BioSoil plot according to the diameter thresholds shown above. Forest deadwood (incl. coarse woody debris (D>10 cm), snags, stumps), ground vegetation (vascular plant species list only), and canopy characteristics are assessed performed in the BioSoil subplots 1 and 2 corresponding to a total sampling area of 400 m^2.**

GENERAL PLOT DESCRIPTION

A general description of the Level I plot has been performed according to the description of the EU/ICP-Forests Level 1 plots (UN-ECE, 2004). Under the BioSoil demonstration project, this description is validated in the field.

The following complementary parameters are included:

- the previous land use,
- the origin of actual stand
- the forest management such as thinning and selective felling
- the type of forest
- the removal of coarse woody debris

- the pattern of tree mixture
- the age of the dominant tree layer
- the prevalent slope of plot (prevalent slope of the BIOSOIL plot in percent (%)
- the plot orientation (prevalent orientation of the BioSoil plot in 8 main geographic directions).
- the fencing of the plot

The complementary parameters definitions and codes are found in the reference tables.

THE EUROPEAN FOREST TYPE CLASSIFICATION

An ecologically oriented categorisation of the plots is useful for stratification and interpretation of forest plot information throughout Europe. At present a number of different forest type classifications have been proposed to classify the forests of Europe into broad classes based on EUNIS (European Union Nature Information Scheme) and the BEAR project (Larsson et al., 2001). The forest type classification adopted in the BioSoil biodiversity project follows the TBFRA and EUNIS definitions and uses the same methodology as the expanded BEAR forest type classification (Barbati *et al*., 2004).

A parallel study to BioSoil has classified the Level 1 points into broad forest types based on the main tree species and some few other selection criteria using the existing data of the Monitoring Programme (Chirici et al., 2005). A system using the nomenclature developed by the EEA is used, which classifies Europe into 14 forest types. This process will allow verification of other systems of forest classification and should also be a very useful tool to permit pre-stratification of the plots at national level for sampling purposes.
The European Forest Type Classification performed in the BioSoil will comprise the verification at the plot level of the pre-assessed forest type classification of the Level 1 (EEA system). A description of the European Forest Type classification is given in http://reports.eea.europa.eu/technical_report_2006_9/en. A list of the forest type for each Level I plot of the countries will be delivered by the JRC. Countries will confirm this or supply corrected information at the data entry.

STRUCTURAL BIODIVERSITY

Forest structure is of interest in biodiversity monitoring due to its use by forest organisms, i.e. habitat range. The measurement of forest structure provides an important, robust and repeatable indicator of forest biodiversity. Structural diversity including tree diameter, tree species composition of all trees on the BioSoil sampling plot, deadwood and canopy characteristics, are assessed on the 16 km x 16 km grid as a minimum requirement of the BioSoil project.

TREE DIAMETER DISTRIBUTION, SPECIES COMPOSITION, TREE HEIGHT, AND CANOPY BASE

The tree diameter distribution is used to describe the structure of the forest stand. The diameter at breast height (DBH at 130 cm) and the species of all woody plants are recorded on standing and lying, living and dead, trees taller than 130 cm. DBH measurements are recorded across the entire BioSoil sampling subplots 1, 2, and 3 using different diameter thresholds in each of the three subplots (see below). Trees are considered to be part of the BioSoil plot if the centre of the stem is inside the sampling plot.

METHOD

The DBH is recorded in cm only and as follows:

- Subplot 1: DBH > 0 cm and taller than 130 cm
- Subplot 2: DBH ≥ 10 cm
- Subplot 3: DBH ≥ 50 cm

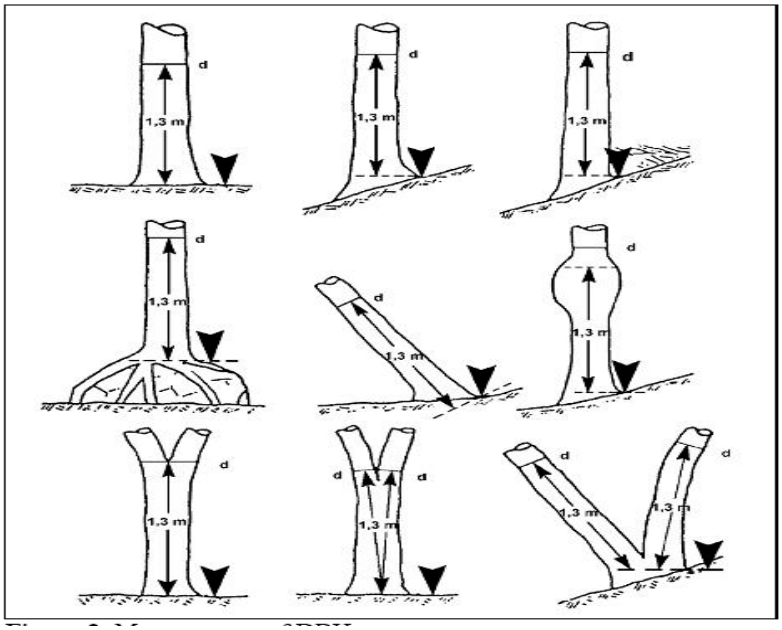


Figure 2. **Guidelines for the measurements of DBH (diameter at 130 cm) in special cases.**

1. Mandatory

- All trees (standing and lying, living and dead) are callipered (or measured by tape) at DBH (130 cm) if the height is greater than 130 cm. Reminder: snags are only registered in subplots 1 and 2.
- Tree species is recorded for all measured living and dead trees according to the species list.
- Tree status is also recorded: (1: standing living, 2: standing dead, 3: lying dead). For standing and lying dead trees, decay state is also recorded

- Tree top height and height of base of the canopy layer are measured on a minimum of 3 trees with the largest DBH across the entire BioSoil sampling subplots 1, 2, and 3 regardless the tree species.

2. Optional
- distance from plot centre to each tree (in meters with 1 decimal)
- azimuth from plot centre to each tree (in degrees 360^{o})

When measuring 130 cm above the ground, it is not necessary to remove litter; however, measure below any large woody debris (e.g., down logs or branches) that may be at the base of the tree, see Figure 2.

To ensure that the breast height is precisely assessed, use a pin of precisely 130 cm when callipering the trees with a height of more than 130 cm. DBH is always measured uphill, from the left side of the tree (with respect to the plot centre), perpendicular to the axis of the tree and always with the ruler of the calliper pointing towards the centre of the plot. If there is abnormal growth on the stem at breast height then the calliper is turned or moved to the closest normal place on the stem. The trees may be marked with chalk after being callipered to avoid repetition of the measurement.

Special considerations for the DBH measurements in the inner BioSoil subplot 1 may arise, where all trees higher than 130 cm are measured, may arise. Under situations with high stem numbers, because of e.g. coppices or natural regeneration, where DBH measurements become impractical in the field, a proportion of the total may be measured instead of all trees. The total number of trees in the subplot and the sampling fraction used are to be reported, to allow estimates to be made of the structure of the subplot.

Standing and lying dead trees are callipered, whether there is bark present or not. In cases where the breast height occurs on the broken part of a tree, then calliper the tree at this breast height.

TREE HEIGHT AND CANOPY BASE MEASUREMENTS

Minimum 3 dominant trees according to the largest measured DBH are selected for tree height measurements using e.g. a clinometer or a Vertex. The base of the canopy layer is also recorded on the same trees. The tree heights and canopy base measurements are made across the entire BioSoil sampling subplots 1, 2, and 3.

FOREST DEADWOOD

Forest deadwood is an important component of forest ecosystems in providing habitat, nutrients and shelter to a range of forest organisms. Forest deadwood is a recognised indicator of forest biodiversity as it helps to describe the quality and status of habitats, and the structural diversity within a forest. The forest deadwood assessment involves

mandatory measuring of standing and **lying dead trees**[1], coarse woody debris (CWD), **snags**, and **stumps**.

Lying deadwood components, with diameter greater than 10 cm, are considered as coarse woody debris (CWD) and are assessed by a full sampling within the subplots 1 and 2. Coarse woody debris (CWD) includes stems, limbs, branches lying on the ground occurring inside the inner subplots 1 and 2.

The mandatory inventory of CWD does NOT include woody pieces less than 10 cm in diameter, dead shrubs, self-supported by their roots, trees showing any sign of life, dead foliage, bark or other non-woody pieces that are not an integral part of a stem or limb, roots or main stem below the root collar. When a piece of CWD has irregular diameter along its length, the section under 10 cm in diameter is not considered.

Fine woody debris is measured as an option only using the same approach as CWD but using a 5 cm threshold in this case.

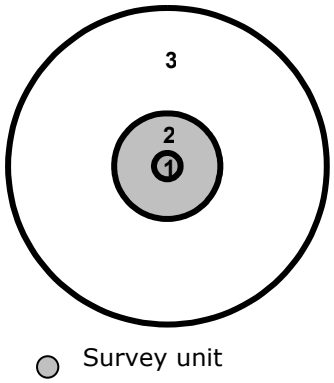


Figure 3. *Survey units for coarse woody debris, snags, and stumps.*

METHOD

A **stump** is measured if the centre of the stump is inside the subplots 1 or 2, if stump height (or length if lying) is less than 130 cm from the base and if the diameter at cut is greater than 10 cm. The height (or length if lying) of the stump is measured from stump base until the point where the tree was cut (or where the stem has broken off). The stump diameter is measured at cut height.

A **snag** is defined as a standing deadwood without branches, with a height greater than 130 cm and with a DBH greater than 10 cm (DBH > 10 cm). **If branches are present**, the snag is considered as **standing dead tree** and should be measured with respect to diameter threshold in subplots 1, 2, and 3 (DBH at 130 cm, see Table 3 and refer to the chapter "Tree diameter distribution, species composition, tree height"). **If branches are absent** and if the centre of the snag is inside the subplots 1 or 2 then **snag height and diameter** at half snag height are recorded. Diameter mensuration can be done

[1] *As standing and lying dead trees are concerned, refer to the chapter "Tree diameter distribution, species composition, tree height"*

callipering the snag at 130 cm and visually adjusting the recording to the midpoint of the snag with respect to the 10 cm diameter threshold (Figure 5**). If the snag is less than 130 cm** in height it is considered and measured as a **stump**.

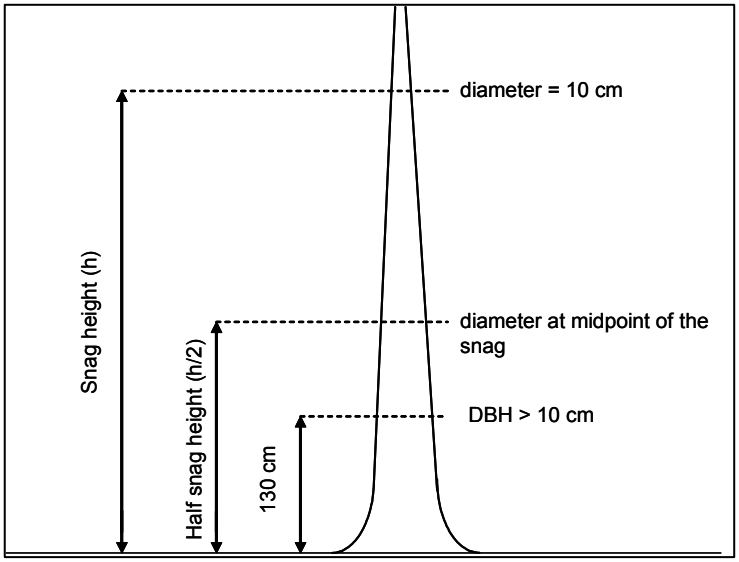


Figure 4. *Procedure for snag diameter and snag height measurement.*

A **coarse lying woody debris** is surveyed if its diameter at thicker end is greater than 10 cm and if more than 50% of its thicker end lies within the subplots 1 or 2. Diameter measurements are recorded at the mid-point of the CWD piece with diameter greater than 10 cm. The length of the lying woody debris in metres and with 1 decimal is measured from its thicker end until the point after which the size of the diameter is always under 10 cm. The diameter at half length of the piece is also recorded (Figure 5).

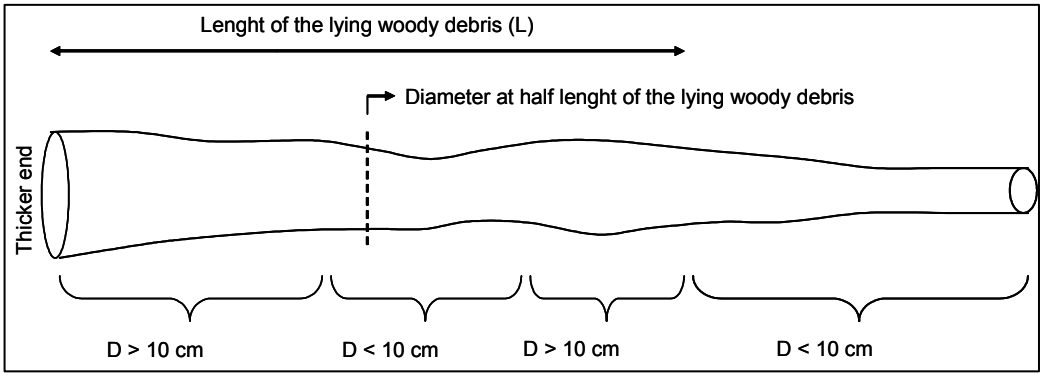


Figure 5. *Procedure for measure length and diameter at half length of a coarse lying woody debris.*

The forest deadwood measurements include:

1. Mandatory

- Diameter (in cm) and length (in m) of coarse lying woody debris
- Species of the coarse woody debris if possible (see species list)
- Height (in m) and diameter (in cm) of stump less than 130 cm in height with a diameter at normal cut height greater than 10 cm
- Species of stump if possible (see species list)
- Estimated diameter of snag (cm) and snag height (in m)
- Species of snag if possible (see species list)
- Decay state (5 classes) of all deadwood components (see figure 6).

2. Optional

- Diameter (in cm) and length (in m) of fine woody debris
- Species of fine woody debris species if possible (see species list)

The diameter and length of fine woody debris is measured when the diameter of the woody material is equal to or smaller than 10 cm but greater than 5 cm.

CANOPY CHARACTERISTICS

The canopy structure has widespread ramifications on the function of the forest ecosystem and its suitability to support other species. It plays an important role for the regeneration of trees as well as for understorey species. They can also serve as early warnings for changes in the abundance of difficult to measure species including endangered species and soil species.

The BioSoil project includes **estimates of canopy closure** and **number of tree layers**.

Canopy closure is estimated as the amount of shade that the canopies of trees create on the ground. Canopy closure is agreed to be estimated visually, but it can be estimated more precisely using a spherical densiometer to measure this amount of shade. The instrument has a round concave mirror with a grid marked on it. The grid divides the mirror into small squares.

METHOD

The visual estimates of **average canopy closure** are made for each of the BioSoil subplots 1 and 2. Estimates of canopy closure are expressed in 5 % classes; see reference table for codes.

The visual overall estimate of the number of **distinct tree layers** on BioSoil plot is assessed at the same location as for the ground vegetation within the two BioSoil subplots 1 and 2**;** see reference table for codes.

COMPOSITIONAL BIODIVERSITY

GROUND VEGETATION

The species diversity of the understorey vegetation represents an important component of overall forest biodiversity. The diversity and abundance of vegetation has also been linked to the diversity of specific faunal groups by many research projects. In the scope of the BioSoil project, only the vascular plant species have been chosen as a compositional indicator of biodiversity. Other components like bryophytes, lichens, and etc. while recognised as important components of forest biodiversity are not mandatory to record on this occasion. The number of tree layers occurring above the ground vegetation sample areas should also be recorded.

Following the recommendations of the EU/ICP Forest Expert Panel on Ground Vegetation, vascular plant species are assessed across the minimum sampling area of 400 m^2.

Vascular plant species are assessed by a full sampling within the inner subplots 1 and 2. Species are described according to the Flora Europaeae and the species codes found in the Manual are used.

As an option, the entire ground vegetation component can be assessed using the approach outlined in the Ground Vegetation Manual (**www.icp-forests.org/pdf/manual8.pdf**).

GLOSSARY AND DEFINITIONS

Canopy base

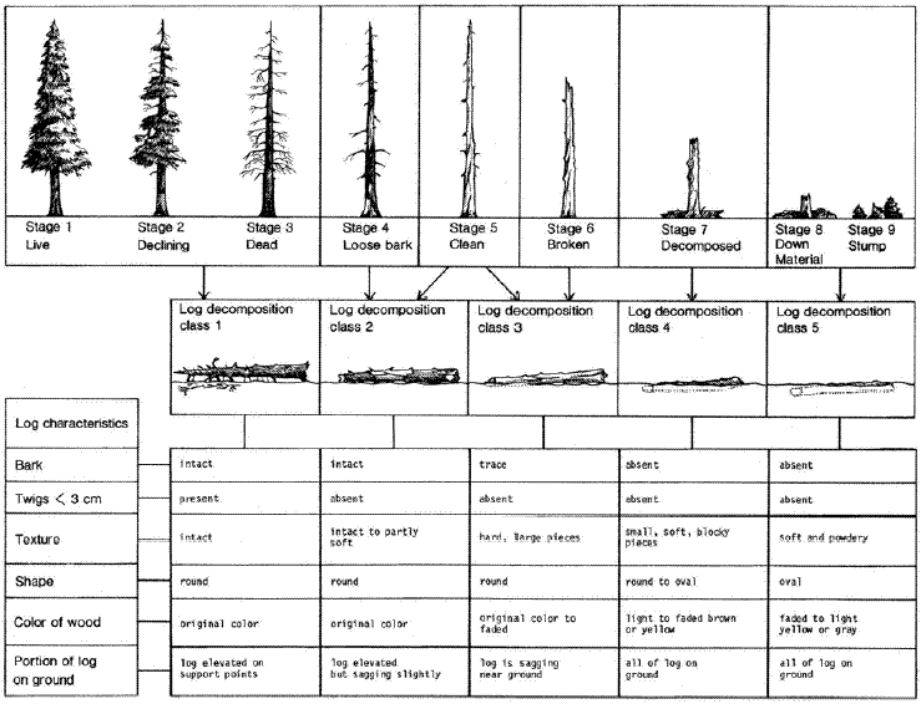
The canopy base is the height from the ground to the bottom of the live crown of an individual tree (starting at the lowest main branches of the tree).

Coppicing

A tree cutting method based on renewal of newly cut trees by vegetative reproduction like sprouting, growth of several stems from one root system.
'Coppice with standards' includes scattered trees that are left to grow as normal ('standards')
'Coppice without standards' is considered to be simple coppice.

Deadwood

- ***Coarse woody debris (CWD):*** Pieces of lying wood with a diameter at the thicker end of the debris larger than 10 cm. CWD pieces must be detached from a bole and not self supported by a root system with a lean angle of more than 45 degrees from vertical
- ***Decay class (1 – 5)***. The deadwood decomposition is assigned in 5 decay classes according to Hunter 1990. **Figure 6**:



- ***Fine woody debris (FWD):*** Lying woody debris with a diameter between 5 cm < D < 10 cm
- ***Lying dead tree:*** Whole tree lying on the forest floor – the tree must be recognisable and the rooted part must be within the plot to be considered. The diameters of lying dead tree are recorded according to the diameter threshold of:
  - DBH > 0 cm and taller than 130 cm in the BioSoil Subplot 1,
  - DBH ≥ 10 cm in the BioSoil Subplot 2,
  - DBH ≥ 50 cm in the BioSoil Subplot 3.

- ***Snag:*** A snag is defined as standing dead tree **without branches with height greater than 130 cm**, otherwise it may be considered as a standing dead tree if it has branches and is taller than 130 cm or as a stump if the height is less than 130 cm. If branches are present treat as standing dead tree and record the DBH at 130cm height.
- ***Standing dead tree:*** *S*tanding dead tree with a height taller than 130 cm and **with** branches.
- ***Stump:*** Standing dead tree with a height less than 130 cm and also including stumps.

Intimacy

The mixture of different tree species in the plot can be described as *intimate* and *non-intimate*: *Intimate* relates to a mixture of different tree species throughout the stand
Non-intimate, relates to a mixture of different tree species in small groups or clusters.

High forest

Type of forest where the trees are mainly grown from generative formation/multiplication (by seeds)

- ***Even-aged stand:*** A stand or forest type, in which no or relatively small age differences exist among individual trees within it, usually less than 20% of rotation length (IUFRO, 2000).
- ***Uneven-aged stand:*** Consisting of trees of a range of age classes, with age differences which are significant in relation to the stand structure management and rotation length (IUFRO, 2000).
- ***Femelschlag:*** Progressive cutting. This is a type of regeneration in high forests in which parcels of different sizes or groups of trees are regenerated by combining different cuttings (progressive, shelter, edge) in successions over in time and space and in a given order.
- ***Plenterwald*****:** Forest with a layered structure, without a dominant development stage or a high forest with one to several layers with a structure by groups of trees. Trees of all diameter classes are growing together and where the same type of silvicultural activities in the stand is always applied.
- ***High forest homogeneous*****:** High forest of homogeneous stands with delimitated area, with a uniform structure (with 1-several tree layers), in which the trees of the main stand have diameter at breast height of same size and are thus assimilated to the same stage of development.
- ***Young to medium forest*****:** Class of forest defined by the mean or dominating diameter or height. Depending on the dominating diameter and the inventory, different development stages can be distinguished increasing from young growth of dense vegetation with regeneration, to rigid stems, to young forest defined as a group of trees (not coppices) grown in a way that some of them have reach or will reach the forest stage (middle forest: diameter of e.g. 40 to 50 cm and old forest: diameter of more than 50 cm, depending on country definitions).

Regeneration
Re-establishment of a forest stand by natural or artificial means following the removal of the
previous stand by felling or as a result of natural causes, e.g. fire or storm (TBFRA 2000).

- ***Natural regeneration:*** Re-establishment of a forest stand by natural means, i.e. by natural seeding or vegetative regeneration. It may be assisted by management operations, e.g. by scarification or fencing to protect against wildlife damage or domestic animal grazing (TBFRA 2000).
- ***Regeneration by planting and seeding:*** The act of establishing a forest stand (e.g. plantation) or re-establishing a forest stand by artificial means, either by planting of seedlings or by scattering seed. The material used may be of indigenous or introduced origin. Planting and seeding may take place on forest, other wooded land or other land (TBFRA 2000).

Stand
A community of trees possessing sufficient uniformity in composition, age, arrangement or condition to be distinguishable from the forest or other growth on adjoining areas, thus
forming a temporary silvicultural or management entity (IUFRO, 2000).

UTM coordinates

A position on the Earth is referenced in the UTM system by the UTM longitude zone, the projected distance of the position from the central meridian - called the Easting - and the projected distance of the point from the equator - called the Northing.

The point of origin of each UTM zone is the intersection of the equator and the zone's central meridian. In order to avoid dealing with negative numbers, the central meridian of each zone is given a "false Easting" value of 500,000 meters. Thus, anything west of the central meridian will have an Easting less than 500,000 meters. For example, UTM Easting range from 167,000 meters to 833,000 meters at the equator (these ranges narrow towards the poles). In the northern hemisphere, positions are measured northward from the equator, which has an initial "Northing" value of 0 meters and a maximum "Northing" value of approximately 9,328,000 meters at the 84th parallel -- the maximum northern extent of the UTM zones.

DATA CODES AND FIELD FORMS

GENERAL BIOSOIL PLOT DESCRIPTION

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	Observation plot number of the BioSoil plot (max. 9999)	Number	99999	
DATE	Date of the assessment /measurements	Date	DDMMYYYY	
GPSPLOT	Georeferencing the BIOSOIL plot centre	0: No, 1: Yes	9	
DATUM	Geodesic system WGS84, ETRS89	Text	Text	
PROJECT	Projection	Text	Text	
UTMZONE	UTM longitude and latitude zone, e.g. 32V, Europe includes 27V to 38S	Text	Text	
EASTSOIL	**Easting** of the BioSoil soil pit	Metres	999999	
NORTHSOIL	**Northing** of the BioSoil soil pit	Metres	9999999	
EASTPLOT	**Easting** of the BioSoil plot centre	Metres	999999	
NORTHPLOT	**Northing** of the BioSoil plot centre	Metres	9999999	
C_ACCURACY	Accuracy of GPS location estimate	1-3		REF_ACCURACY
GPSELEV	Elevation reading from the GPS of the plot centre in metres	Metres	9999.9	
C_ORIENT	Prevalent orientation of the BioSoil plot	1-9	9	REF_ORIENT
AVSLOPE	Prevalent slope of the BIOSOIL plot in percent	%	999	
C_PREVUSE	Previous land-use	1-5	9	REF_PREVUSE
C_ORIGIN	Origin of the actual stand	1-5	9	REF_ORIGIN
C_MANAGE	Forest management such as thinning and selective felling	1-4	9	REF_MANAGE
C_FORTYPE	Forest Type	1-8	9	REF_FORTYPE

C_DWREMOV	Removal of coarse woody debris	1-7	9	REF_DWREMOV
C_TREEMIX	Pattern of tree mixture See also glossary for explanations	1-3	9	REF_TREEMIX
C_AGE	Mean age of the dominant storey (in 20 year classes from 1-8 and unknown (=9))	1-9	9	REF_AGE
C_FENCE	Fencing	1-3	9	REF_FENCE
C_EFTC	European Forest Type Classification	1-14	99	REF_EFTC
OTHER_OBS	Remarks	Text	Text	

STRUCTURAL BIODIVERSITY 1: DBH, SPECIES COMPOSITION

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	Observation plot number of the BioSoil plot (max. 9999)	Number	99999	
SUBPLOT	BioSoil subplot	1,2,3	9	
DATE	Date of survey	Date	DDMMYYYY	
TREENO	Tree number	Number	9999	
DBH	DBH (at 130cm) in cm	cm	999	
C_TSTATUS	Status of trees: Standing and lying, living and dead trees: if branches are still present then standing dead tree; if without branches then snag (go to table with CWD, snags and stumps).	1-3	9	REF_TSTATUS
DISTANCE	If tree position is measured: Distance between the BioSoil plot centre and the tree (in metres)	metres	9999.9	
AZIMUTH	If tree position is measured: Azimuth (Compass direction) from the centre of the BioSoil plot to the tree (360 deg: North=0)	Degrees (0-359)	999	
C_TSPECIES	Tree species		999	REF_TSPECIES
C_DECAY	Only for standing and lying dead trees	1-5	9	REF_DECAY
OTHER_OBS	Remarks	Text	Text	

STRUCTURAL BIODIVERSITY 2: TREE HEIGHT AND CANOPY BASE

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	BioSoil plot number		9999	
SUBPLOT	BioSoil subplot (1, 2, 3)	1 or 2	9	
DATE	Date of survey	Date	DDMMYYYY	
TREENO	Number of the tree where tree height is measured		999	
C_TSPECIES	Tree species *		999	REF_TSPECIES
DBH	DBH (at 130cm) in cm*	cm	999	
TREHEIGHT	Height of the tree (in metres)	metres	99.9	
BASECAN	Height of the base of the canopy layer (in metres)	metres	99.9	
OTHER_OBS	Remarks	Text	Text	

** [NB. These are a repetition of the measurements reported in the DBH file; included here for validation purposes]*

STRUCTURAL BIODIVERSITY 3: COARSE WOODY DEBRIS, SNAGS AND STUMPS

Countries who wish to carry out more detailed assessments, should include full callipering of all the deadwood components listed above plus if desired lying fine woody debris and accumulations according to the standard protocol outlined in the ForestBiota manual (www.forestbiota.org).

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	BioSoil plot number		9999	
SUBPLOT	BioSoil subplot (1, 2). In case of use of the random selected units use (3, 4, 5, and 6 for unit a ,b , c, and d, respectively).	1 or 2	9	
DATE	Date of survey	Date	DDMMYYYY	
C_DWTYPE	Type of the coarse woody debris, snag or stump.	1-5	9	REF_DWTYPE
C_DWSPE	Species of the deadwood	1-3	9	REF_DWSPE

DWDIA	Median diameter for deadwood in cm (above D ≥ 10 cm)		99.9	
DWLEN	Length or height of the deadwood in m (above D ≥ 10 cm)		99.9	
C_DECAY	Decay class of the deadwood The degree of decay is assessed visually and by banking on the wood	1-5	9	REF_DECAY
OTHER_OBS	Remarks	Text	Text	

STRUCTURAL BIODIVERSITY 4: STAND AND CANOPY CHARACTERISTICS

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	BioSoil plot number		9999	
SUBPLOT	BioSoil subplot (1,2). In case of use of the random selected units use (3, 4, 5, and 6 for unit a ,b , c, and d, respectively).	1 or 2	9	
DATE	Date of survey	Date	DDMMYYYY	
C_CANCLO	Canopy closure score (Open is 0% and full closure is 100%)	1-5	99	REF_CANCLO
C_TREELAY	Number of tree layers	1-5	9	REF_TREELAY
NO_OF_TREES	Total number of trees within the subplot that are measured for DBH (ie all trees >130cm for subplot 1; all trees with a DBH>10 for subplot 2)		9999	
SAMP_PERC	Percentage of trees assessed for DBH (normally 100% unless total number of trees make this impractical)		999	
OTHER_OBS	Remarks	Text	Text	

DATA CODES: GROUND VEGETATION

NAME	Description	Code	Format	Reference table
SEQ	Sequence number of plots (1 to 9999)		9999	
C_COUNTRY	Country code (France=01, Belgium=02, etc.)	1-96	99	REF_COUNTRY
PLOTID	BioSoil plot number		9999	
SUBPLOT	BioSoil subplot (1, 2). In case of use of the random selected units use (3, 4, 5, and 6 for unit a ,b , c, and d, respectively).	1 or 2	9	
DATE	Date of survey	Date	DDMMYYYY	
GVSPEC	Species code from the Flora Europeae		xxx.xxx.xxxx	
C_LAYER	Surface layer	1-6	9	REF_LAYER
COVER	Percent cover	0-100%	999	
OTHER_OBS	Remarks	Text	Text	

REFERENCE TABLES

REF_ACCURACY

Code	Description
1	Less than 1 metre
2	1- 10 metres
3	10-50 metres

REF_AGE

Code	Description
1	0-20 years
2	21-40 years
3	41-60 years
4	61-80 years
5	81-100 years
6	101- 120 years
7	>120 years *(corresponds to the yearly measured mean age of the crown condition survey)*
8	Irregular stands
9	Unknown

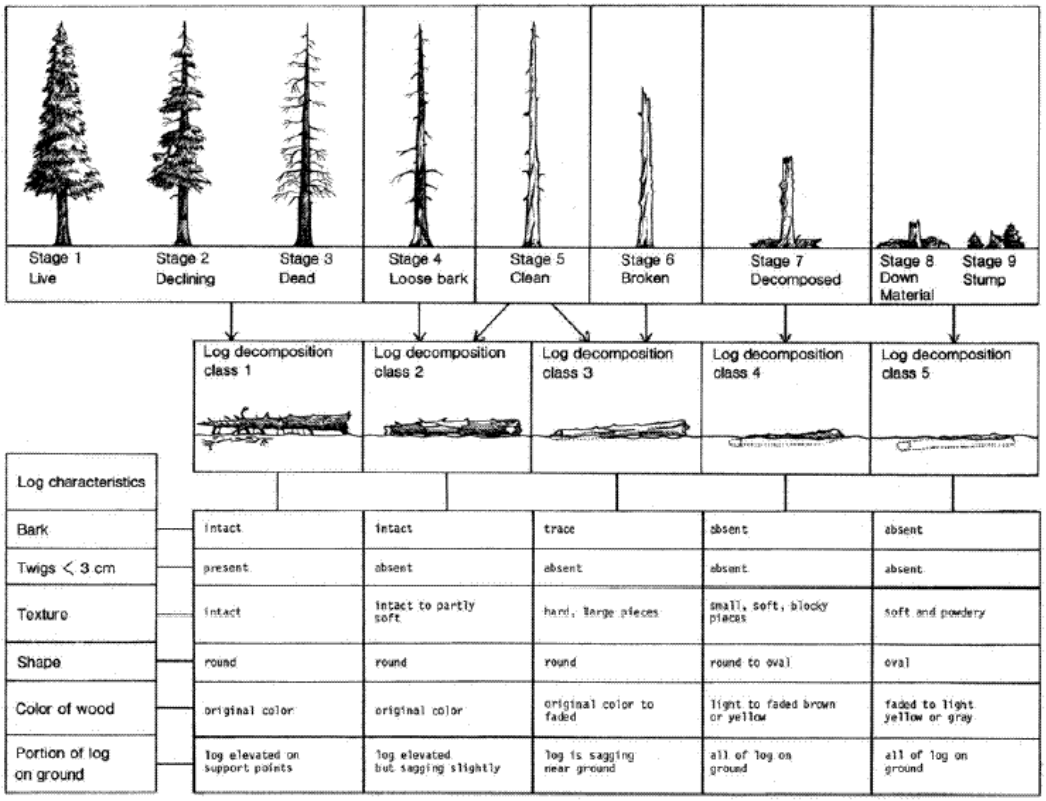
REF_CANCLO

Code	Description
1	Open sky
2	1-25%
3	25-50%

4	50-75%
5	>75%

REF_DECAY

Code	Description
1	No evidence of decay
2	Solid wood. Less than 10 % changed structure due to decomposition; the wood is solid at its surface. The wood is attacked only to a very small degree by wood decomposing organisms
3	Slightly decayed. 10-25% of the wood has a changed structure due to decomposition. This can be assessed by sticking the wood with a sharp object
4	Decomposed wood 26-75% of the wood is soft to very soft
5	Very decomposed wood. 76% - 100 % of the wood is soft



REF_DWREMOV

Code	Description
1	Yes, all stems and main branches have been removed
2	Yes, stems and main branches have been removed
3	No, stems and main branches are lying in the forest
4	partly, some stems and main branches have been removed, others still present
5	Unknown
6	Introduced
7	Presence of accumulation (branches have been stacked in piles or in rows)

REF_DWSPE

Code	Description
1	Deciduous
2	Conifer
3	Unknown

REF_DWTYPE

Code	Description
1	Coarse woody debris (D>10 cm) *Coarse woody debris includes stems, limbs, branches lying on the ground with a diameter of 10 cm*
2	Fine woody debris (5 cm <D<10 cm) *Fine woody debris includes wood pieces with a diameter between 5.0 and 10.0 cm*
3	Snag *Standing deadwood without branches, with a height > 130 cm and with a DBH > 10 cm.*
4	Stump (snag H<130 cm) *Stump is a snag with a height of less than 130 cm*
5	Other

REF_EFTC

Code	Description
1	Boreal forest
2	Hemiboreal and nemoral Scots pine forest
3	Alpine coniferous forest
4	Atlantic and nemoral oakwoods, Atlantic ashwoods and dune forest
5	Oak-hornbeam forest
6	Beech forest
7	Montaneous beech forest
8	Thermophilous deciduos forest
9	Broadleaved evergreen forest
10	Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions
11	Swamp forest
12	Floodplain forest
13	Native plantations
14	Exotic plantations and woodlands

REF_FENCE

Code	Description
1	Fenced
2	Not Fenced
3	Fenced in parts

REF_FORTYPE

Code	Description
1	High forest (even-aged) – Femelschlag
2	High forest (even aged) – Small groups
3	High forest (uneven aged) – Plenterwald
4	High forest (other)
5	Young/Medium forest (under development to high forest)
6	Coppice without standards
7	Coppice with standards
8	Other

REF_LAYER

Code	Description
1	Tree layer
2	Shrub layer
3	Herb layer
4	Moss layer
5	Lower Shrubs (FR)
6	Upper Shrubs (FR)

REF_MANAGE

Code	Description
1	Unmanaged (no evidence)
2	Management (evidence but for more than 10 years ago)
3	Managed (within the last 10 years)
4	Unknown

REF_ORIENT

Code	Description
1	N
2	NE
3	E
4	SE
5	S
6	SW
7	W
8	NW
9	Flat

REF_ORIGIN

Code	Description
1	Planted
2	Seeded
3	Natural regeneration
4	Mixed
5	Unknown

REF_PREVUSE

Code	Description
1	Forested more than 300 years
2	Forested more than 100 years
3	Forested for 25 – 100 years ago
4	Forested in the past 25 years
5	No information

REF_TREELAY

Code	Description
1	1 layer (one dominant tree layer)
2	2 layers (dominant tree layer plus 1 sublayer)
3	3 layers (dominant plus 2 sublayers)
4	More than 3 layers
5	0 layer, no tree layer

REF_TREEMIX

Code	Description
1	Intimate (different tree species are mixed throughout the stand)
2	Non-intimate (different trees occur in clusters)
3	No mixture

REF_TSTATUS

Code	Description
1	Standing living tree
2	Standing dead tree
3	Lying dead tree