FOREST FOCUS DEMONSTRATION PROJECT
BIOSOIL 2004-2005

THE BIOSOIL
FOREST BIODIVERSITY
FIELD MANUAL

VERSION 1.0

FOR THE FIELD ASSESSMENT
2006-07

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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 complimented 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 policy, international and national, 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 of 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 (including snags and stumps)
  - Canopy closure and tree layering
- Compositional forest diversity
  - Ground vegetation (vascular plant species list)

Time schedule

The project is foreseen to follow the time schedule outlined below in Table 1.

Table 1. Work plan of the BioSoil biodiversity study

Project period: From:	01.01.2006	To:	31.12.2007	2006				2007			
Main activities over the project period				1	2	3	4	1	2	3	4
Preparation, training				x	x						
A workshop including a pre-field sampling to ensure a harmonised approach for the project					x						
Field assessment of the selected parameters					x	x	x	x	x	x	
Data management and reporting											x

PLOT DESIGN

The manual of crown condition assessment gives detailed instructions of crown condition plot establishment and operation. Despite this, at present 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 sample point level rather than at a sample plot of known and fixed area.

For the purposes of this demonstration project, BioSoil proposes to sample forest biodiversity components 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 divided in three circular subplots: an outer plot (subplot 3) with a radius of 25.24 m (2000 m^2) and including 2 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

Optionally for specific surveys within the BioSoil plot such as ground vegetation and forest deadwood 4 randomly selected squares of 10 m x 10 m (so called random sampling units A, B, C and D) may be established within the 2000 m^2 plot while still respecting the overall BioSoil subplot layout 1, 2 and 3 for the other surveys e.g. DBH. The random selection is carried out by first generating a random azimuth and random distance from the centre of the BioSoil plot to establish a corner of the random sampling unit A. From this first sampling unit the other three sampling units B, C and D may be established by using the same azimuth and distance as for plot A but rotated through 90^o on each occasion. These sampling units should not overlap, see Figure 2.

The random sampling units A,B, C and D are used optionally only instead of the recommended BioSoil subplots 1 and 2 where countries desire to do so. It is not mandatory to establish the random sampling Units A, B, C and D in the BioSoil plot and where they are established they may be used for ground vegetation and coarse woody debris assessments only. When they are not established, vegetation and deadwood surveys are conducted in BioSoil subplots 1 and 2 only.

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 subplots 1 and 2. Where the BioSoil plot occurs on steep slopes, and slope correcting factors are used they should be recorded and noted in the data forms along with the average slope of the plot.

Method

It is important to be able to record the exact centre of the plot. This can be ensured by registration with GPS coordinates complemented by simple maps and azimuth along with distance assessments allowing for a precise location of the plot. It is also recommended to draw simple diagrams, and to take photos of the plot to assist possible future plot relocation. 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) but the GPS registration is mandatory to the project.

The diagrams should include several identifiable elements (road, large tree, rivulet, etc). These elements will help to find the plot again if the GPS is not satisfactory or if the metal pin has disappeared.

Table 2. The basic BioSoil circular sampling plot of 25.24 m radius, consisting of 3 subplots of different radii and **optionally** for specific surveys 4 randomly selected square sampling units (A, B, C, and D)

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)
Unit A, B, C, and D	Square	10 m x 10 m (100 m2)

*distance from the center of the plot.

Figure 1. ***The BioSoil Plot design***. *Coarse woody debris (stumps and snags), ground vegetation and canopy characteristics are measured in the BioSoil subplots 1 and 2 (a total sampling area of 400 m2). Tree species and DBH are recorded across the entire BioSoil sampling plot.*

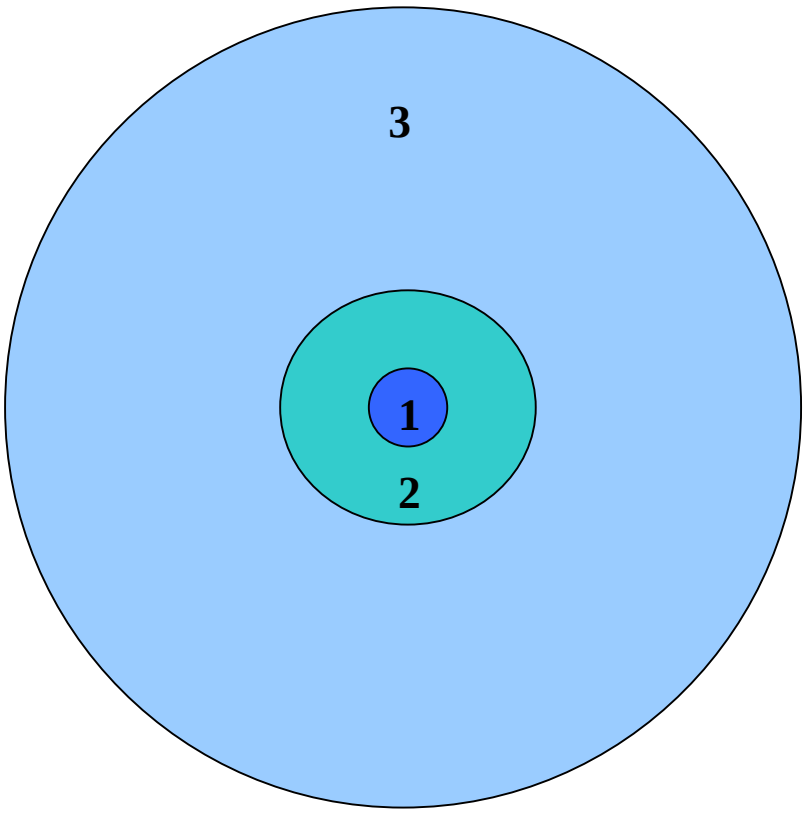
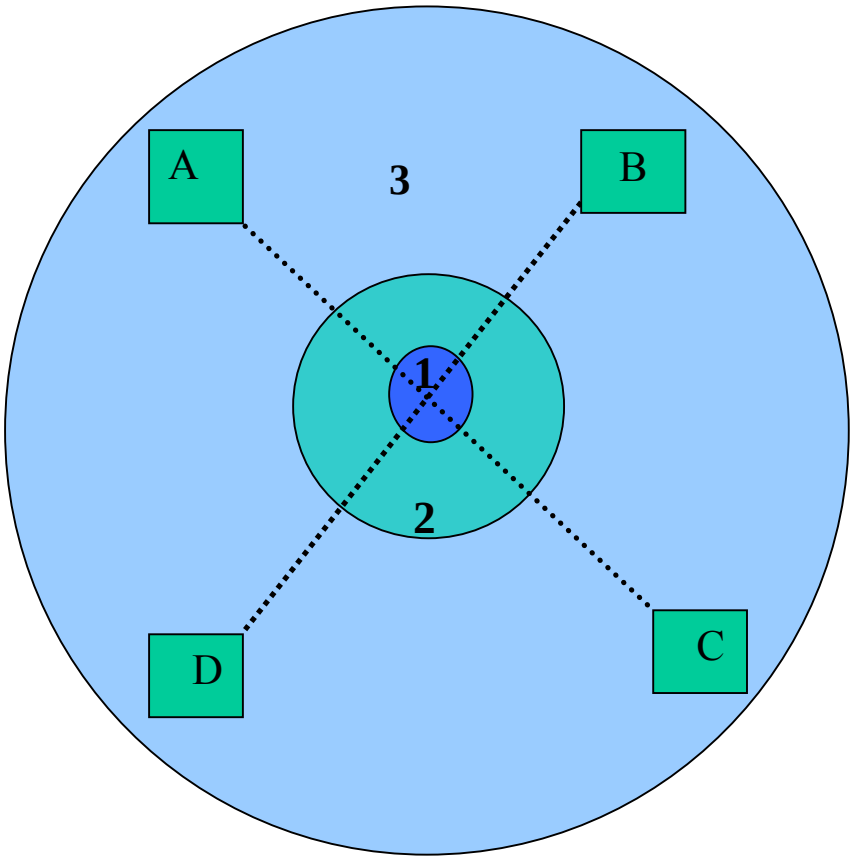


Figure 2. Optional *BioSoil Plot design. Optionally* ***four 10 m x 10m random sampling units*** *may be* ***installed for specific surveys instead of using the recommended subplots 1 and 2 for ground vegetation and forest deadwood. Note that the combined sampling area of sampling units A, B C and D must be equivalent to subplots 1 and 2 (400m^2).***



Geo-referencing

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 by the European Commission

Method

The GPS coordinates are read using the GPS equipment and is 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 3 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 form and eventually also on the simple drawing. In

the event that the plot center 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 center should then be noted,

OVERVIEW OF THE BIOSOIL PLOT MEASUREMENTS

	Subplot 1 30 m^2	Subplot 2 400 m^2	Subplot 3 2000 m^2	Randomly selected sampling units A B C D
General plot description	yes			-
Check of the forest type classification	yes			-
DBH and species of all woody plants taller than 130 cm (standing and lying living and dead trees)	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 5 trees			
Coarse woody debris (incl. stumps and snags)	D > **10 cm**	D > **10 cm**	- OR	yes
Canopy closure (visual)	Yes			
Tree layering (visual)	Yes			
Ground vegetation –vascular species list only	Yes	Yes	OR	

Table 3. ***Mandatory minimum requirements 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 sampling plot according to the diameter thresholds shown above. Forest deadwood (coarse woody debris incl. stumps and snags, ground vegetation (vascular plant species list only) are measured in a total sampling area of 400 m^2. Ground vegetation and forest deadwood surveys may be performed in* ***EITHER*** *the two BioSoil subplots 1 and 2* ***OR*** *in the randomly selected sample units A. B, C and D of 10 m x 10 m each.*

GENERAL PLOT DESCRIPTION

The 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:

- Previous land use
  1. forested since > 300 years
  2. forested since > 100 years

3. forested for more than 100 years
4. 50 years
5. forested in the past 25 years
6. no information

- Origin of stand
  1: planted
  2: seeded
  3: natural regeneration
  4: mixed
  5: unknown

- Forest management
  1. Unmanaged (no evidence)
  2. Abandoned management
  3. Managed
  4. Unknown

- Forest Type
  1: high forest (even-aged) - femelschlag
  2: Coppice without standards
  3: Coppice with standards
  4: Plantation
  5: Uneven-aged forest (plenter wald)
  6: Medium forest
  7: High forest (even-aged) - small groups
  8: Other

- Harvesting method
  1. Clear cut
  2. Shelterwood cut
  3. Clear cut with reservoirs
  4. Selection cut (plenterwald)
  5. Thinning (even aged stands)
  6. Other
  7. None

- Removal of coarse woody debris
  1: yes
  2: no
  3: partly
  4: unknown
  5: introduced
  6: presence of accumulation

- Ownership information
  1. State, province, region, municipality forest
  2. Private forest
  3. Other
  4. Unknown

- Pattern of tree mixture
  1: intimate
  2: non-intimate (clusters)

3. no mixture

Definitions

- non-intimate: where different tree species occur in clusters
- intimate: where different tree species are mixed throughout the stand

- Age of the dominant tree layer
  1: 0-20 years
  2: 21-40
  3: 41-60
  4: 61-80
  5: 81-100
  6: >100 years
  7: irregular stands
  8: unknown

- Slope

prevalent slope of the BIOSOIL plot in absolute figures (degrees)

- Orientation

prevalent orientation of the BIOSOIL plot, (1 = N, 2 = NE, …, 8 = NO, 9 = flat):

- Fencing of the plot
  1: fenced
  2: not fenced
  3: fenced in parts

FOREST TYPE CLASSIFICATION

An ecologically oriented categorisation of the plots is required 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, 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 (Barbatti *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 28 general 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 forest type classification 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 list of the forest type for each Level I plot of the countries will be delivered by the JRC upon request.

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

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 sub-plots (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

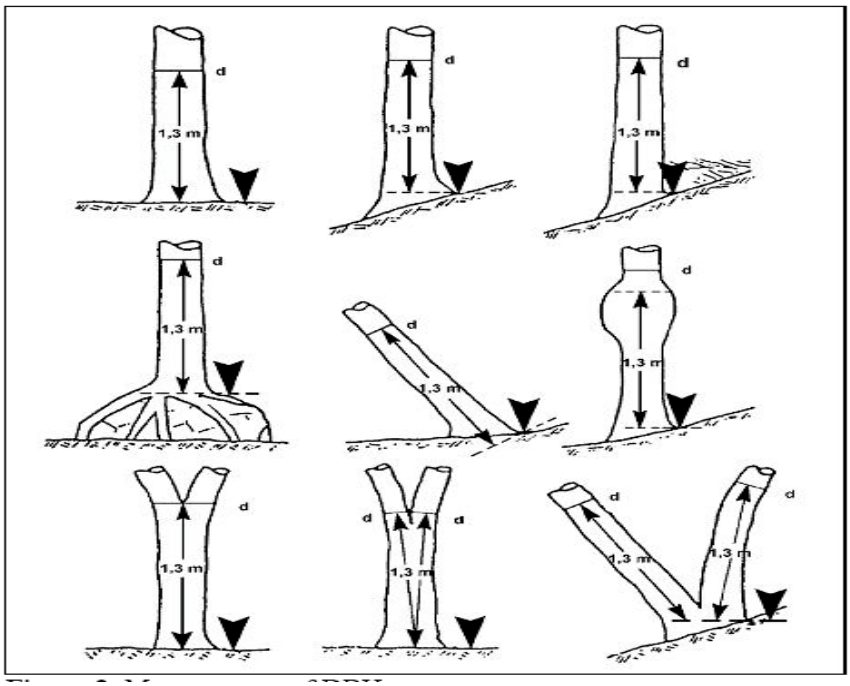


Figure 3. Guidelines for the measurements of DBH (diameter at 130 cm) in special cases (reference?).

1.Mandatory

- All trees (standing and lying, living and dead) are calipered (or measured by tape) at DBH (130 cm) if the height is greater than 130 cm.
- Tree species is recorded for all measured living and dead trees according to the species list.

- Tree status is recorded as well: (condition code 1= standing living, 2= standing dead, 3= lying dead).
- Tree top height and height of base of the canopy layer are measured on 3 to 5 trees with the greatest DBH across the entire BioSoil sampling subplots 1, 2, and 3 and regardless the tree species.

2. Optional

- distance from plot center to each tree (in meters with 1 decimal)
- azimuth from plot center 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 (Figure 3).

To ensure that the breast height is precisely assessed, use a pin of precisely 130 cm when calipering 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 caliper 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 are marked with chalk when calipered to avoid repetition of the calipering .

Special considerations for the DBH measurements in the inner BioSoil subplot 1, where all trees higher than 130 cm are measured may arise. Under situations with high stem number because of e.g. coppices or natural regeneration, where DBH measurements become impractical in the field, then simply count the number of stems by species only.

Standing and lying dead trees are calipered 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 measurements

3-5 dominant trees according to the largest measured DBH are selected for tree height measurements using e.g. a Vertex. The base of the canopy layer is also recorded on the same trees.

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 lying dead trees, coarse woody debris (CWD), snags, and stumps. Forest deadwood components with diameter greater than 10 cm are considered as coarse woody debris and assessed by a full sampling within either the inner subplots 1 and 2 or the four randomly selected square BioSoil sampling units A, B, C and D. *Fine woody debris* is measured as **an option only** using the same approach as CWD but using a 5 cm threshold in this case.

Coarse woody debris (CWD) includes stems, limbs, branches lying on the ground occurring in the inner subplots 1 & 2 OR in the 4 square optional sampling units. 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. Lying dead trees are calipered at 130 cm from their base and with a diameter of at least 10 cm.

The length of the coarse woody debris is only measured when the diameter of the CWD piece is at least 10 cm. When a piece of CWD has irregular diameter along its length, the section under 10 cm in diameter is not considered. Diameter measurements are recorded at the mid-point of the CWD piece with diameter greater than 10 cm, see diagram.

Stumps are considered where the stump height (or length if lying) is less than 130 cm from the base and the diameter at least 10 cm. Stumps are recorded if they occur in the inner subplots 1 & 2 or 4 square optional sampling units. The stump diameter is measured at normal cut height.

A snag is defined as a standing dead wood without branches with height greater than 130 cm and with a diameter of at least 10 cm. If branches are present, the snag is considered as standing dead tree and should be measured with respect to diameter to diameter threshold in subplots 1,2 , and 3 (DBH at 130 cm).

If branches are absent, the snag is treated in the following way: diameter estimates of snags are performed by calipering the snag at 130 cm and visually adjusting the recording to the midpoint of the snag with respect to the 10 cm diameter threshold to give an estimate of the snag diameter. Height of the snag is also measured up to the 10 cm limit of the snag.

If the snag is less than 130 cm in height treat like a stump.

The forest deadwood measurements include:

1. Mandatory
• Diameter (in cm) of coarse woody debris and length (in m)
• Species of the coarse woody debris if possible (see species list)
• Diameter of stump (cm) 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

2. Optional
• Diameter (in cm) of fine woody debris and length (in m).
• 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 CWD piece is less than 10 cm but greater than 5 cm.

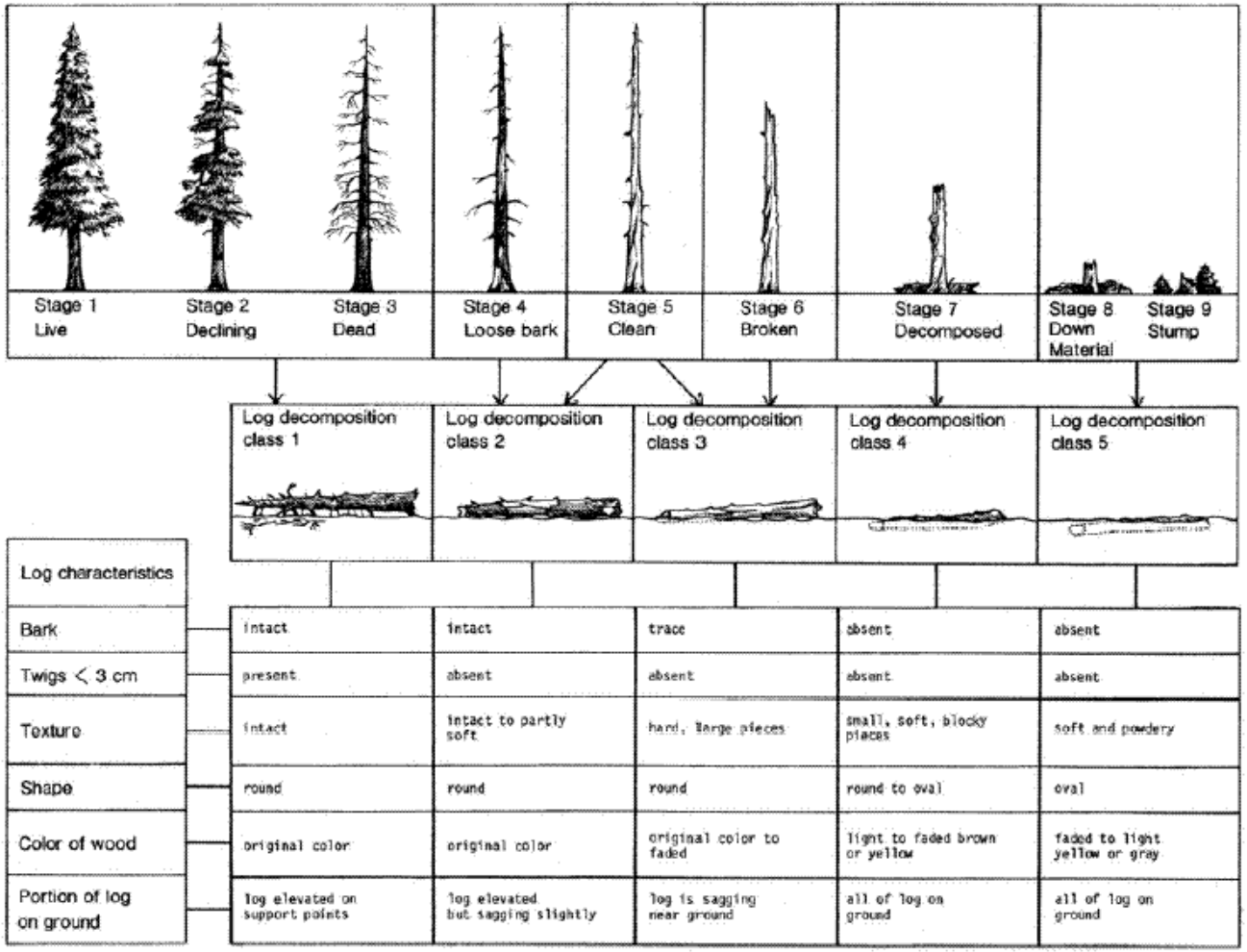


Figure 4. ***Decay class (1 – 5).*** The deadwood decomposition is assigned in 5 decay classes according to Hunter, 1990.

Canopy characteristics

The canopy structure has widespread ramifications on the function of the forested ecosystem and its suitability to support other species. It plays an important role for the regeneration of trees as well as for understory 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 can be estimated visually or 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

1. Visual estimates of average canopy closure are made for each of the BioSoil subplots 1, 2 and 3 and for each of the random sampling units A, B, C and D when used. Estimates of canopy closure are expressed in 5 % classes: (1: 0, 2: 1-5%, 3: 6-10%, etc.)
2. 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, **EITHER** within the two BioSoil subplots 1 and 2 **OR** in the randomly selected sample units A. B, C and D of 10 m x 10 m each and according to the following classes (1: 1 layer (dominant canopy), 2: 2 layers (dominant plus 1 sublayer), 3: 3 layers (dominant plus 2 sublayers), 4: more than 3 layers, 5: o layer (absence of canopy layer)).

COMPOSITIONAL BIODIVERSITY

Ground vegetation

The species diversity of the understory 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 list are assessed on mandatory across the minimum sampling area of 400m^2 and **as a minimum requirement on the 32 km x 32 km grid.**

Vascular plant species list are assessed by a full sampling within EITHER the inner subplots 1 and 2 OR the four optionally selected square sampling units A, B, C and D. Species are described according to the Flora Europaea 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).

DATA CODES AND FORMS

Tree species list (Reference: Flora Europaea)

Broadleaves
001: Acer campestre
002: Acer monspessulanum
003: Acer opalus
004: Acer platanoides
005: Acer pseudoplatanus
006: Alnus cordata
007: Alnus glutinosa
008: Alnus incana
009: Alnus viridis
010: Betula pendula
011: Betula pubescens
012: Buxus sempervirens
013: Carpinus betulus
014: Carpinus orientalis
015: Castanea sativa (C. vesca)
016: Corylus avellana
017: Eucalyptus sp.
018: Fagus moesiaca
019: Fagus orientalis
020: Fagus sylvatica
021: Fraxinus angustifolia spp. oxycarpa (F. oxyphylla)
022: Fraxinus excelsior
023: Fraxinus ornus
024: Ilex aquifolium
025: Juglans nigra
026: Juglans regia
027: Malus domestica
028: Olea europaea
029: Ostrya carpinifolia
030: Platanus orientalis
031: Populus alba
032: Populus canescens
033: Populus hybrides
034: Populus nigra
035: Populus tremula
036: Prunus avium
037: Prunus dulcis (Amygdalus communis)
038: Prunus padus
039: Prunus serotina
040: Pyrus coomunis
041: Quercus cerris
042: Quercus coccifera (Q. calliprinos)
043: Quercus faginea
044: Quercus frainetto (Q. conferta)
045: Quercus fruticosa (Q. lusitanica)
046: Quercus ilex
047: Quercus macrolepis (Q. aegilops)
048: Quercus petraea
049: Quercus pubescens
050: Quercus pyrenaica (Q. toza)
051: Quercus robur (Q. pedunculata)
052: Quercus rotundifolia

053: Quercus rubra
054: Quercus suber
055: Quercus trojana
056: Robinia pseudoacacia
057: Salix alba
058: Salix caprea
059: Salix cinerea
060: Salix eleagnos
061: Salix fragilis
062: Salix sp.
063: Sorbus aria
064: Sorbus aucuparia
065: Sorbus domestica
066: Sorbus torminalis
067: Tamarix africana
068: Tilia cordata
069: Tilia platyphyllos
070: Ulmus glabra (U. scabra, U. scaba, U. montana)
071: Ulmus laevis (U. effusa)
072: Ulmus minor (U. campestris, U. carpinifolia)
073: Arbutus unedo)
074: Arbutus andrachne
075: Ceratonia siliqua
076: Cercis siliquastrum
077: Erica arborea
078: Erica scoparia
079: Erica manipuliflora
080: Laurus nobilis
081: Myrtus communis
082: Phillyrea latifolia
083: Phyllyrea angustifolia
084: Pistacia lentiscus
085: Pistacia terebinthus
086: Rhamnus oleoides
087: Rhamnus alaternus
088: Betula tortuosa
090: Crataegus monogyna
099: Other broadleaves

Conifers
100: Abies alba
101: Abies borisii-regis
102: Abies cephalonica
103: Abies grandis
104: Abies nordmanniana
105: Abies pinsapo
106: Abies procera
107: Cedrus atlantica
108: Cedrus deodara
109: Cupressus lusitanica
110: Cupressus sempervirens
111: Juniperus communis
112: Juniperus oxycedrus
113: Juniperus phoenicea
114: Juniperus sabina

115: Juniperus thurifera
116: Larix decidua
117: Larix kaempferi (L.leptolepis)
118: Picea abies (P. excelsa)
119: Picea omorika
120: Picea sichensis
121: Pinus brutia
122: Pinus canariensis
123: Pinus cembra
124: Pinus contorta
125: Pinus halepensis
126: Pinus heldreichii
127: Pinus leucodermis
128: Pinus mugo (P. montana)
129: Pinus nigra
130: Pinus pinaster
131: Pinus pinea
132: Pinus radiata (P.insignis)
133: Pinus strobus
134: Pinus sylvestris
135: Pinus uncinata
136: Pseudotsuga menziesii
137: Taxus baccata
138: Thuya sp.
139: Tsuga sp.
140: Chmaecyparis lawsonia
199: Other conifers

DATA CODES: GENERAL BIOSOIL PLOT DESCRIPTION:

NAME	Description	Code	Format
GPSBPLOT	Georeferencing the BIOSOIL plot centre	0: No, 1: Yes	
DATUM	Datum	Text	
PROJECT	Projection	Text	
LATSOIL	Latitude of the BioSoil soil pit		
LONGSOIL	Longitude of the BioSoil soil pit		
LATPLOT	Latitude of the BioSoil plot centre		
LONGPLOT	Longitude of the BioSoil plot centre		
GPSELEV	Elevation reading from the GPS in meters		
ORIENT	Orientation of the BioSoil plot	1: N 2: NE 3: E 4: SE 5: S 6: SW 7: W 8: NW 9: flat	
DISTANCE	Distance between the BioSoil plot centre and a GPS measuring point if it is not measured in the plot centre (in meters)		
AZIMUTH	Azimuth (Compass direction) from the GPS to the centre of the BioSoil plot if it is not the same as the plot centre in degrees (360 deg)		
SLOPE	Prevalent slope of the BIOSOIL plot: 1 meter height difference on 20 meters corresponds to a slope of 5%.	1: totally flat (<1%) 2: flat (2-4%) 3: almost flat (5-10%) 4: flat slope (11-25%) 5: steep slope (>25%)	
ORIGIN	Origin of the stand	1: planted 2: seeded 3: natural regeneration 4: mixed 5: unknown	
PREVLUSE	Previous land-use	1. forested since > 300 years 2. forested since > 100 years 3. forested for more than 100 years 4. forested for more than 50 years	•

		5. forested in the past 25 years 6. no information	
MANAGE	Forest management	1. Unmanaged (no evidence) 2. Abandoned management 3. Managed 4. Unknown	
HARVEST	Harvesting method	1. Clear cut 2. Shelterwood cut 3. Clear cut with reservoirs 4. Selection cut (plenterwald) 5. Thinning (even aged stands) 6. Other None	
OWNER	Ownership information	1. State, province, region, municipality forest 2. Private forest 3. Other 4. Unknown	
DWREMOVE	Removal of coarse woody debris	1. yes 2. no 3. partly 4. unknown 5. introduced 6. presence of accumulation	
AGE	Age of the dominant tree layer	1. 0-20 years 2. 21-40 3. 41-60 4. 61-80 5. 81-100 6. >100 years 7. irregular stands 8. unknown	
FOTYPE	Forest Type	1. high forest (even-aged) - femelschlag 2. Coppice without standards 3. Coppice with standards 4. Plantation 5. Uneven-aged	

		forest (plenter wald) 6. Medium forest 7. High forest (even-aged) - small groups 8. Other	
TREEMIX	Pattern of tree mixture	1. intimate 2. non-intimate (clusters) 3. no mixture	
FENCE	Fencing	1. fenced 2. not fenced 3. fenced in parts	

DATA FORMS: GENERAL BIOSOIL PLOT DESCRIPTION

BioSoil PLOT Number: _____
Date: __/__/20__ Team:_____

NAME	INFORMATION	COMMENTS
NAME		
GPSBPLOT		
DATUM		
PROJECT		
LATSOIL		
LONGSOIL		
LATPLOT		
LONGPLOT		
GPSELEV		
ORIENT		
DISTANCE		
AZIMUTH		
SLOPE		
ORIGIN		
PREVLUSE		
MANAGE		
HARVEST		
OWNER		
DWREMOVE		
AGE		
FOTYPE		
TREEMIX		
FENCE		

DATA CODES: STRUCTURAL BIODIVERSITY – DBH AND SPECIES COMPOSITION AT BREAST HEIGHT

NAME	Description	Code	Format
SUBPLOT	BioSoil Subplot 1: BioSoil Subplot 2: BioSoil Subplot 3:	1: DBH > 0 cm 2: DBH ≥ 10 cm 3: DBH ≥ 50 cm	Max 9999
TREENO	Tree number		
DBH	DBH (at 130cm) in cm		999
TREESTAT	Status of trees: Living tree, dead standing tree or lying dead tree	1: standing living tree 2: standing dead tree 3: lying dead tree	
DISTANCE			
AZIMUTH			
TREESPEC	Tree species	See tree species list	
DECAY	Only for standing and lying dead trees!	Class 1-5	

DATA FORM: STRUCTURAL BIODIVERSITY – DBH AND SPECIES COMPOSITION

BioSoil PLOT Number: __________
Date: __/__/20__   Team:______________________

SUBPLOT	TREENO	DBH	TREESTAT	DISTANCE	AZIMUTH	TREESPEC	DECAY

DATA CODES: STRUCTURAL BIODIVERSITY – DEADWOOD

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
SUBPLOT	BioSoil Subplot 1: BioSoil Subplot 2: BioSoil Subplot 3:	1: DBH > 0 cm 2: DBH ≥ 10 cm 3: DBH ≥ 50 cm	
DWTYPE	Type of the lying deadwood code 1-5 is recorded on LIS, code 6 on full sampling unit area.	1. unknown 2. coarse woody debris (D>10 cm) 3. fine woody debris (5 cm <D<10 cm) 4. stump (snag H<130 cm)	
DWSPE	Species of the deadwood	1. unknown 2. deciduous 3. conifer	
DWDIA	Median diameter for deadwood in cm (D ≥ 10 cm)		99.9
DWLEN	Length or height of the deadwood in cm		99.9
DECAY	Decay class of the deadwood (code 1-5) The degree of decay is assessed visually and by banking on the wood and according to Hunter's 5 decay classes see Figure 4	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	

DATA FORM: STRUCTURAL BIODIVERSITY – LYING DEADWOOD

PLOT Number: _________
Date: __/__/20__ Team:_____________________

SUBPLOT	DWTYPE	DWSPE	DWDIA	DWLEN	DECAY

DATA CODES: STRUCTURAL BIODIVERSITY – TREE HEIGHT, HEIGHT OF CANOPY BASE, CANOPY CLOSURE, NUMBER OF TREE LAYER

NAME	Description	Code	Format
SUBPLOT	BioSoil Subplot 1: BioSoil Subplot 2: BioSoil Subplot 3:	1: DBH > 0 cm 2: DBH ≥ 10 cm 3: DBH ≥ 50 cm	
TREENO	Number of the tree where tree height is measured		
TREHEIGHT	Height of the tree (in meters)		
BASECAN	Height of the base of the canopy layer (in meters)		
CANCLO	Canopy closure expressed in percent 0-100%	1. open sky 2. 1-25% 3. 25-50% 4. 50-75% 5. >75%	
TREELAY	Number of tree layers	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 (absence of tree layer)	

DATA FORM: STRUCTURAL BIODIVERSITY – TREE HEIGHT AND HEIGHT OF THE CANOPY BASE

PLOT Number: _____
Date: __/__/20__ Team:_____

SUBPLOT	TREENO	TREHEIGHT	BASECAN

DATA FORM: STRUCTURAL BIODIVERSITY – CANOPY CLOSURE AND NUMBER OF TREE LAYERS

PLOT Number: _____
Date: __/__/20__ Team:_____

SUBPLOT	CANCLO	TREELAY	

DATA CODES: GROUND VEGETATION

NAME	Description	Codes	Format
SUBPLOT	BioSoil Subplot 1: BioSoil Subplot 2: BioSoil Subplot 3:	1: DBH > 0 cm 2: DBH ≥ 10 cm 3: DBH ≥ 50 cm	
GVSPEC	Species code from the Flora Europaea	See species list	xxx.xxx .xxxx

DATA FORM: GROUND VEGETATION

PLOT Number: _________
Date: __/__/20__ Team:_____________________

GROUND VEGETATION

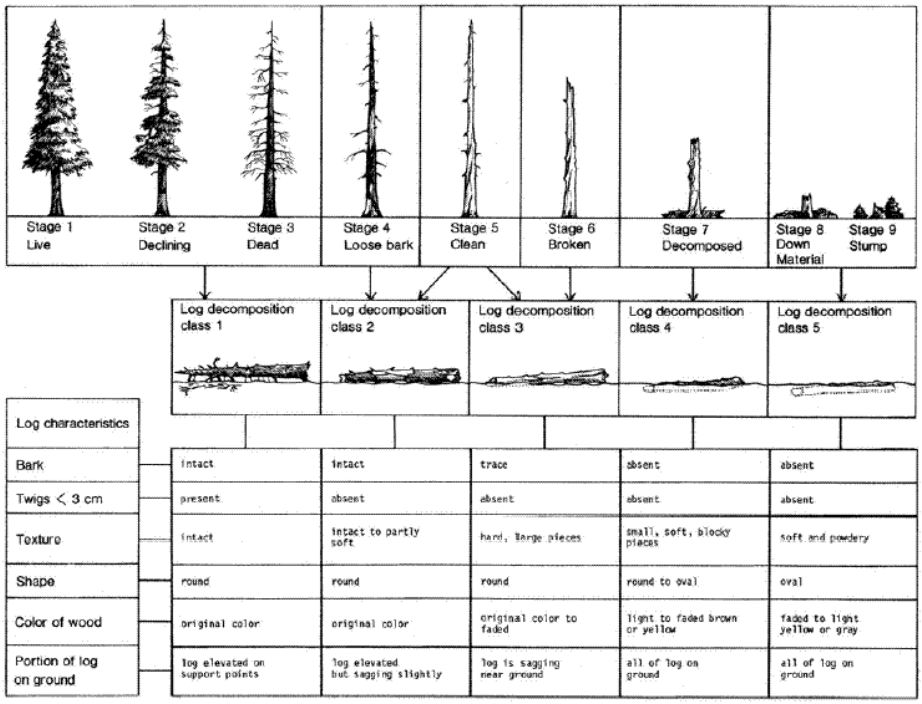
SUBPLOT	GVSPEC

Appendix

Definitions

Coarse woody debris: Lying woody debris with a diameter D >10 cm

Decay class (1 – 5). The deadwood decomposition is assigned in 5 decay classes according to Hunter 1990.



Fine woody debris: Lying woody debris with a diameter between 5 cm < D < 10 cm

Intimate: Tree mixture can be described as intimate and non-intimate. *Intimate* relates to where different tree species are mixed throughout the stand, *non-intimate,* to here different tree species occur in clusters.

Lying dead tree: whole tree lying on the forest floor – the tree must be recognisable and the rooted within the plot to be considered. Diameter 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, and DBH > 50 cm in the BioSoil Subplot 3.

Snag: A snag is defined as standing dead wood without branches with height greater than 130 cm, otherwise it may be considered as a stump. If branches are present treat as standing dead tree and record the DBH at 130cm height.

Standing dead tree: all standing dead trees with a height taller than 130 cm.

Stump: standing dead tree with a height less than 130 cm also including stumps.

References

Larsson T. B. (ed.), 2001. *Biodiversity Evaluation Tools for European forests*. Ecological Bulletins N. 50

Barbati, A., Carraro, G., Corona, P., Del Favero, R., Dissegna, M., Lasen, C., Marchetti, M., 1999. *Developing biodiversity assessment on a stand forest type management level in north-eastern Italy.* Annali Accademia Italiana di Scienze Forestali XLVIII: 157-176.

Chirici, G. et al. 2005. *Forest type for biodiversity assessment. Stratification of Level 1 plots of Europe.* Final report of the Forest Focus project "Forest type classification of the Level 1".

Hunter, M. L., Jr., 1990. *Wildlife, Forests and Forestry: Principles of Managing Forests for Biological Diversity.* Prentice-Hall, Englewood Cliffs, New Jersey.