Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz

Johann Heinrich von Thünen-Institut

Survey instructions

for the

3rd National Forest Inventory

(2011-2012)

2nd revised version, May 2011

with 4. Corrigendum (21.03.2014)

Survey instructions for the 3rd National Forest Inventory (2011-2012)

2nd revised version, May 2011

Published by:
Federal Ministry of Food,
Agriculture and Consumer Protection
Bundesministerium für Ernährung,
Landwirtschaft und Verbraucherschutz (BMELV)
Referat 535, Friedrich Schmitz
Postfach, 53107 Bonn
Contents:
Dr. H. Polley, Institut für Waldökologie und Waldinventuren im
Johann Heinrich von Thünen-Institut,
Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei

In cooperation with the *Länder*
Dr. G. Kändler, Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg
Dr. M. Bachmann, Bayerische Landesanstalt für Wald und Forstwirtschaft
J. Müller, Landesforstanstalt Eberswalde, Brandenburg
T. Ullrich, Hessen-Forst Forsteinrichtung und Naturschutz
R. Neuß, Landesforst Mecklenburg-Vorpommern
U. Neupert, Niedersächsische Landesforsten AöR / Niedersächsisches Forstplanungsamt
L. Falkenried, Landesbetrieb Wald und Holz Nordrhein-Westfalen
J. Diesler, Zentralstelle der Forstverwaltung, Rheinland-Pfalz
E. Fritz, Saarforst-Landesbetrieb
M. Schmid, Staatsbetrieb Sachsenforst
E. Binnemann, Landeszentrum Wald Sachsen-Anhalt
R. Hinrichsen, Ministerium für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein
S. Stiefel, Thüringer Landesanstalt für Wald, Jagd und Fischerei

Printed by: BMELV

May 2011, Bonn

Survey instructions for the 3rd National Forest Inventory (2011-2012)

2nd revised version, May 2011

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (publisher)
Institut für Waldökologie und Waldinventuren im Johann Heinrich von Thünen-Institut, Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei
In cooperation with the *Länder*

zuletzt geändert 30.01.2015 14:51

Survey instructions for the 3rd National Forest Inventory

Table of contents

Annexes:

Figures:

1 General information

1.1 Scope of application

These survey instructions apply to the implementation of § 41a of the Federal Forest Act and the third National Forest Inventory Ordinance of 23 May 2007 (Federal Law Gazette I, p. 954).

The survey instructions for the third National Forest Inventory (NFI 2012) contain the directions, definitions, attribute descriptions and attribute values with key codes. They regulate the collection, control and communication of data.

It addresses employees of the Federal Government and the *Länder*, as well as contractors who collect, control, communicate and evaluate data.

Chapter 1 gives an overview of the organisation of the National Forest Inventory.

Chapter 2 explains the main characteristics of the inventory procedure.

Chapter 3 describes the preliminary details of the cluster to be gathered before the outdoor surveying phase.

Chapter 4 establishes how the statistical units in the forest are located.

Chapter 5 determines how data are collected in the forest. The description of the data collection process covers the forest/non-forest decision and the identification of sample trees, structural attributes, site attributes, deadwood and forest edges.

The survey instructions replace the General Administrative Regulation on Implementation of the second National Forest Inventory (NFI 2002). The aim of the National Forest Inventory is to provide an overview of the forest conditions and the forest production potential over an extended area in Germany.

1.2 Coordination of the National Forest Inventory

The compilation and evaluation of the data and the coordination tasks they entail are undertaken by the Federal Ministry of Food, Agriculture

and Forestry (Federal Ministry). For this purpose, it calls on the Johann Heinrich von Thünen Institute[1] (national inventory administration) which cooperates directly with the *Land* inventory administrations.

In particular, the coordination tasks include:

- discussing all questions of importance with the *Land* inventory administrations to ensure that the National Forest Inventory is carried out uniformly, including the inventory inspection results,
- examining the data for plausibility and correcting implausible data,
- evaluating the data,
- clearing up doubts of supraregional importance.

In so far as insight into the conducting of the local inventory is necessary to coordinate the National Forest Inventory, this is ensured by the *Land* inventory administration.

The national inventory administration makes all the data of the former National Forest Inventories necessary for the repeat survey available to the *Land* inventory administrations, as well as the software for the following steps:

- data collection and validation,
- data management (selection as well as import and export of data for survey teams and national inventory administration),
- printout of sketches (maps) of the sample trees from the angle-count sampling.

The addresses of the partners to coordinate the National Forest Inventory at federal level are given in **Annex 1**.

[1] Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestries and Fisheries (http://www.vti.bund.de)

1.3 *Land* inventory administration

The *Land* authority in charge of collecting the data (*Land* inventory administration) has the following tasks:

- planning and coordinating the deployment of the survey teams,
- preparing the documents for the survey teams,
- ensuring the proper collection of the data, including inventory inspection measures,
- controlling and correcting the data in consultation with the national inventory administration,
- releasing the verified data in the central database for use in the national inventory administration,
- informing the national inventory administration of the timetable for carrying out the inventory,
- informing the national inventory administration of additional *Land*-specific surveys.

The addresses of the *Land* inventory administrations are given in **Annex 2.**

1.4 Survey teams

The survey teams are responsible for measuring and describing the forest condition in accordance with these survey instructions and the directions of their *Land* inventory administration. A survey team consists of two people and is led by a qualified graduate forester (or a person with comparable qualifications).

1.5 Training

Up to two members of the *Land* inventory administrations, the leaders of the survey teams and, if necessary, the team members are introduced to the survey procedure and the survey software on behalf of the Federal Ministry.

1.6 Right of access

The persons assigned the task of conducting the National Forest Inventory are entitled, to perform their duties, to enter land and to carry out the necessary work for the inventory on this land (§ 41 a (4) of the Federal Forest Act).

If, when establishing the preliminary details of the cluster areas, it is found that clusters lie in areas used for military purposes, the competent federal forest operation is asked to supplement the missing information to establish the preliminary details of the cluster and to designate the competent authority to grant permission to enter these areas.

The addresses of the Federal Forestry Offices are listed in **Annex 3.**

Where the German Federal Armed Forces have jurisdiction, granting permission to enter is the responsibility of the respective base commander who takes the necessary protection measures on a case-by-case basis. If the *Land* inventory administration does not reach agreement with these authorities on the right of access and the carrying out of the inventory work, it informs the Federal Ministry. The latter decides, in agreement with the Federal Ministry of Finance and the Federal Ministry of Defence, and communicates the result to the *Land* inventory administration.

1.7 Data collection, data validation and data flow

The data and software required for conducting the survey are made available on a server of the national inventory administration. The *Land* inventory administrations have access to the relevant *Land* data and determine the access rights for the survey teams and other authorised persons.

All survey data – apart from the cluster sketch of clusters to be surveyed for the first time (Chapter 4) – are entered into the specific software. The first plausibility check must be carried out by the software immediately after data entry. Each contested entry must be examined and corrected if necessary.

In case of an error message, correction of the entry is imperative as the check routine assesses this entry as wrong. If the check programme shows errors in the corrected data, the national inventory administration must be informed in order to change the check routines, if necessary. In the case of warnings, the relevant data have to be checked and corrected, or the warnings, and thus the values, have to be confirmed.

The survey teams must synchronise the data collected offline with the central NFI database in the national inventory administration on a regular basis.

The *Land* inventory administrations re-examine the data in the central NFI database for plausibility and completeness, using the software made available by the national inventory administration, and make the necessary corrections. To this end, they cooperate with the survey team if necessary or have a new survey carried out to correct the incorrect data.

Brandenburg is in charge of the data collection in Berlin, and Lower Saxony is in charge of the data collection in Hamburg and Bremen.

The *Land* inventory administration releases the completely collected and validated data in the NFI database for use by the national inventory administration.

The national inventory administration then validates these data and clarifies discrepancies with the *Land* inventory administrations. After the data have been released by the *Land* inventory administration, the national inventory administration assumes that all warnings still appearing have been examined and taken into consideration by the teams or *Land* inventory administrations.

1.8 Use of the programmes and stored data

The *Länder* always have access to their data on the central server. The Federal Government provides the *Länder* with the evaluation programmes as soon as the first evaluations of the National Forest Inventory have been completed.

1.9 Inventory inspection

The *Land* inventory administration carries out an inventory inspection on a minimum of 5% of the clusters. Errors and (especially systematic) divergences are cleared up with the respective survey team. A report is drawn up on each inspected cluster, showing the divergences and the measures prompted. Documentation can be provided by way of storing the inspection surveys in the central database.

1.10 Documents and working tools for the survey teams

2 survey instructions for the 3rd National Forest Inventory (NFI 2012)
2 brief guides to the NFI 2012 field software for survey/inspection teams
1 guidelines for the identification of forest trees, shrubs, forest grasses and plants, forest habitat types
6 ranging poles for the first survey (3 suffice for the repeat survey)
1 range finder (recommendation: ultrasonic)
1 25 m measuring tape
2 diameter measuring tapes
1 Relascope (Metric CP or Metric Standard) or comparable device with slope correction and the angle-count factors 1, 2, 4 (k=1, 2, 4)
2 compasses (400 gon)
1 clipboard
1 mobile data-entry terminal with the data-entry software provided by the national inventory administration
1 axe
1 calliper kit for diameters up to 30, 40, 60 cm, including 7 m telescopic rod or other device to measure an upper diameter at any height
1 metal detector
angle sections to mark the sample points, BMELV suggestion: length: 30 cm; width of both angles: 30 mm; thickness: 4 mm; sharpened and then hot-galvanized; material: ferromagnetic steel or austenite-free alloy steel so that it can be found with the help of a metal detector.
forms, maps, chalk
GNSS device according to the needs of the *Länder*

2 Inventory method

2.1 Sample distribution, inventory territory

The sample distribution is based on a regular 4 km x 4 km quadrangle grid (basic grid) which is determined by the Gauß-Krüger coordinates system and covers the entire inventory territory. The starting point of the grid used in the first National Forest Inventory (1986-1990) remains the same. The sample grid is densified in some *Länder* or in parts of some *Länder* to a 2.83 km x 2.83 km or 2 km x 2 km quadrangle grid (Annex to the 3rd National Forest Inventory Ordinance). The national inventory administration provides each *Land* with a list of its coordinates. This list also contains the grid points in the direct vicinity of the *Land* concerned to avoid cases of doubt. The planned densifications are taken into account in this context.

The inventory territory comprises the land surface and the inland waters in Germany.

2.2 Repeat survey

As the third National Forest Inventory (NFI 2012) is a repeat survey throughout Germany, data for many objects are already available from former surveys. Permanent attributes, i.e. attributes the values of which remain unchanged (e.g. site attributes), need not be surveyed again. Obvious errors have to be corrected, however. Other attributes are relatively stable (e.g. type of ownership) and must be verified. Dynamic attributes that usually are subject to change (e.g. DBH for sample tree) have to be surveyed again.

2.3 The inventory cluster

The **inventory cluster** covers a quadrangle with a side length of 150 m. The sides of the cluster are oriented north-south and east-west respectively. They form the boundaries of the cluster. The cluster coordinates give the location of the south-west plot. The data collections are carried out on the plots.

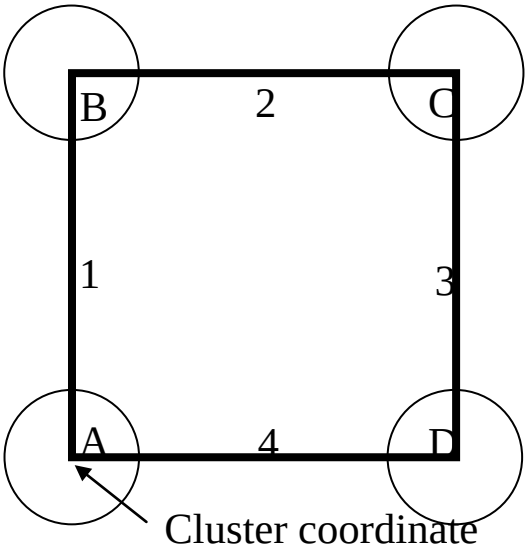


Figure 1: Structure of a cluster with its four plots

Forest clusters

Clusters of which at least one plot is located in a forest (Chapter 5.2) are **forest clusters** and are surveyed in accordance with these instructions.

The objects to be surveyed on the plots are selected with the help of angle-count sampling and sample plots. The surveys to be carried out are shown in Figure 2.

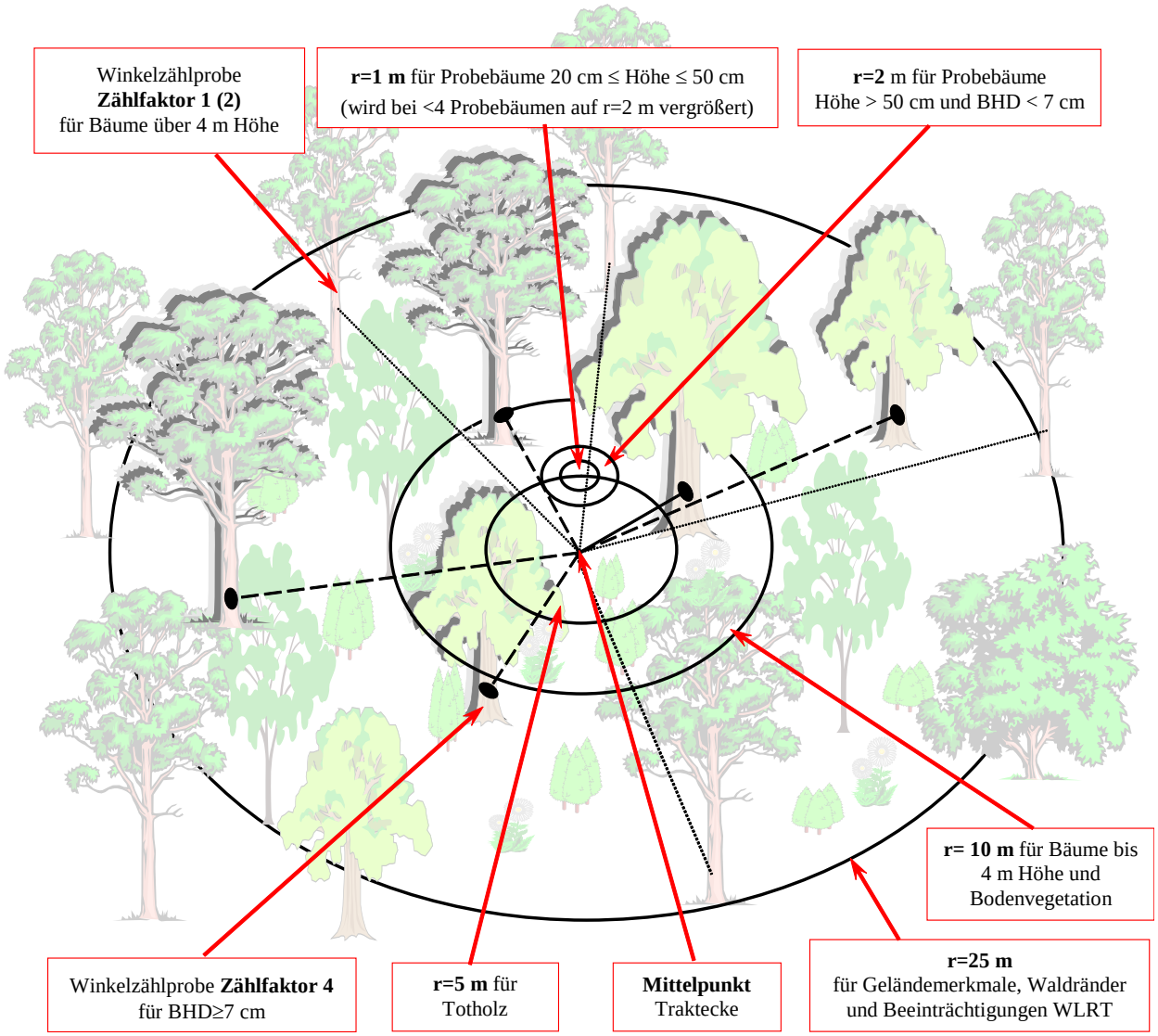


Figure 2: Surveys on the plot

2.4 Angle-count sampling

Every plot in the forest, except unstocked forest land, represents the centre of an angle-count sample with basal area factor 4. Angle-count sampling should also be carried out on temporarily unstocked areas if data on sample trees in the adjacent stand can thus be collected.

Sample trees of the NFI and trees to be described in more detail as a basis for a wide variety of evaluations are, above all, all trees that

- are included in the angle-count sampling (basal area factor 4), and
- are either alive or probably died less than 12 months ago, and
- have a breast-height diameter of at least 7 cm.

In addition, angle-count sampling with basal area factor of 1 or 2 is carried out, counting the trees as a basis for describing the forest structure by species of tree and canopy class (Chapter 5.7.1). For this sampling area, the natural forest community (Chapter 5.7.4) and the forest habitat type (Chapter 5.7.5) are also indicated where necessary and appropriate. At forest edges and on the border to unstocked forest land, the angle-count sampling must be mirrored. Stand boundaries are not taken into account.

2.5 Sample circles

1. A sample circle with a radius of 1 m (or r = 2 m if there are less than 4 sample trees) is usually located 5 m away from the plot to the north (Chapter 5.6). In this sample circle, small trees of 20 cm to 50 cm in height are surveyed.
2. A sample circle with a radius of 2 m is located at the same place. In this sample circle, all trees over 50 cm in height and under 7 cm in breast-height diameter are surveyed (also Chapter 5.6).
3. In a sample circle with a radius of 5 m around the plot, the occurrence of deadwood is determined (Chapter 5.9).
4. In a sample circle with a radius of 10 m around the plot, trees of up to 4 m in height (Chapter 5.7.1) and ground vegetation plant species (Chapter 5.7.2 and, if necessary, Chapter 5.7.5) are surveyed.
5. In a circle of 25 m around the forest plots, site attributes (Chapter 5.8), forest edges (Chapter 5.10) and pressures and threats on forest habitat types (Chapter 5.7.5.6) are recorded.

3 Establishing the preliminary details of the cluster

3.1 Information on the cluster

3.1.1 Cluster identification

The identification of the cluster is necessary to check the data for completeness. It is only necessary for the new clusters resulting from the application of a denser sample grid in the NFI 2012. The other clusters have already been preallocated on the basis of the information from the NFI 2002.

Cluster identification

1 = cluster that is entirely outside the inventory territory and is therefore not covered
2 = cluster on the border between two *Länder* that, on account of different grid-size areas, is only covered in part (<4 plots)
3 = cluster on the border between two *Länder* that is covered in full (4 plots)
4 = normal cluster, located entirely in one *Land* (4 plots)
5 = cluster that is not in the grid of the NFI 2012 and is therefore not covered. This can, for instance, be the case if a grid-size area has not been correctly defined in the list of coordinates.
6 = cluster on the national border that is only covered in part (<4 plots)
7 = cluster on the border of different grid-size areas within one *Land* that is only covered in part (<4 plots)
8 = cluster on the border of different grid-size areas within one *Land* that is covered in full (4 plots)
10 = cluster that is located very close to another cluster and is therefore not covered. This can be the case on the border of two longitude zones.

Data-technical background: The cluster identifications 1 and 5 prevent incorrect error messages during data validation.

3.1.2 Cluster status

The status of the cluster serves as the basis for the decision as to whether a cluster must be visited on site. It has been preallocated with cluster identification 1, 4 or 5 on the basis of the data from the previous survey[2] and is verified with the help of up-to-date forest distribution maps or aerial photographs.

The sample grid is plotted on the map or the aerial photographs. The cluster extends 150 m to the north and to the east from the grid coordinate. Clusters with at least one plot in the forest are forest clusters. Clusters that, according to the map or the aerial photographs, are incontestably situated entirely outside the forest are non-forest clusters. All other cases must initially be considered “uncertain”.

The national inventory administration provides aerial photographs and maps of the cluster environment with the entered clusters in electronic form.

Cluster status

1 = forest cluster of the previous survey
2 = new forest cluster
3 = forest/non-forest decision uncertain
4 = non-forest cluster, situated entirely in a built-up area or in a body of water
5 = non-forest cluster in the open countryside, also partly in a built-up area or in a body of water

Clusters with cluster status 1 to 3 are visited on site.

If a cluster is divided by a *Land* border, the *Land* that conducted the NFI 2002 survey is also responsible for the survey of this cluster. This is usually, and particularly in the case of new clusters, the *Land* in which the grid coordinate (south-west plot) is located. Departures from this general rule are possible in individual cases if the adjoining *Länder* have

[2] this can be the NFI 2002, the inventory study 2008 or a *Land* inventory

agreed in advance and informed the national inventory administration. The *Land* inventory administrations exchange the necessary documents and information for this purpose.

3.1.3 Base map

The base map serves to visit the clusters on site (Chapter 4.1).

First survey	Repeat survey
All clusters classified as forest (2) or uncertain (3) are marked precisely on a large-scale base map (e.g. Deutsche Grundkarte 1:5,000) or suitable electronic maps. The section of the map with the marked cluster serves as a basis for the survey of this cluster. A copy is archived with the national inventory administration.	For all NFI 2002 forest clusters, the NFI 2002 survey locating record is copied. For clusters classified for the first time as forest (2) or uncertain (3), the procedure is the same as it was during the first survey.

The *Land* inventory administrations send copies of the base maps of all forest clusters and copies of the survey locating record in digital form to the national inventory administration for archiving.

3.1.4 Occurrence of hoofed game

With regard to forest clusters, the competent local authority is questioned about the regular occurrence of hoofed game species which is then shown by yes (1) or no (0) for wild boar, red deer, fallow deer, roe deer and mouflons respectively.

3.2 Information on plots

In the repeat survey, the information available from the previous survey is examined and, if necessary, corrected or supplemented.

The attributes under Chapter 3.2.1 are assigned to the plots in any case. All other attributes must only be indicated if the plot lies in the forest.

3.2.1 Assignment of administrative attributes

For each plot, the structural unit (forestry office) is indicated.

Land, district, municipality, forest region, forest area are assigned by the national inventory administration and must be controlled and, if necessary, corrected by the *Land* inventory administrations.

The codes of the NFI database are used for the attributes. No account is taken of later restructuring.

In the case of clusters on the German border, the *Land* assignment "0" is entered for plots located outside of the inventory territory. The other administrative attributes are left blank. For the attribute 'forest' (Chapter 5.2), the indication must be "8" (= irrelevant, because outside of the inventory territory).

In the case of clusters on the border of grid-size areas, only the *Land* is recorded for the plots not belonging to the grid. For the attribute 'forest' (Chapter 5.2), the indication must be "9" (= irrelevant, because not belonging to the grid-size area). All other parameters are left blank.

In the case of clusters bordering on another *Land*, the information for all plots is collected in full. In so doing, care should be taken to use the up-to-date attributes and key codes specific to the *Land*.

3.2.2 Types of ownership

The information on the type of ownership available from a previous survey is verified for each plot (e.g. map of forest estates, cadastral map).

Types of ownership

1 = state forest (national property)
2 = state forest (*Land* property)
3 = communal forest
30 = municipal forest
31 = church forest assigned to communal forest
32 = community forest assigned to communal forest
33 = cooperative forest assigned to communal forest

34 = communal forest under exclusive ownership or under exclusive sponsorship of the *Land* government
35 = communal forest under ownership or under exclusive sponsorship of the national government
4 = private forest
40 = private forest (in the narrower sense)
41 = church forest assigned to private forest
42 = community forest assigned to private forest
43 = cooperative forest assigned to private forest
44 = private forest under exclusive ownership or under exclusive sponsorship of the *Land* government
45 = Private forest under exclusive ownership or under exclusive sponsorship of the national government
5 = forest under Treuhandanstalt[3] administration (Treuhand forest)

The use of the two-digit codes is optional. This is determined uniformly for each *Land.* The primary one-digit code numbers may not be used in this case.

The following codes are used in the *Länder*:

BB, BE, NW, RP, SH, SL,	One-digit codes
BW, BY, HB, HE, HH, MV, NI, SN, ST, TH	Two-digit codes

3.2.3 Ownership size classes

Communal and private forests are classified into the ownership size classes indicated below. This classification is made according to the forest area managed by the same enterprise or by the same operating office.

If necessary, forest owners should be asked which ownership size class they should be assigned to. This will ensure that forest ownership unknown to the inventory staff is not ignored. The decisive factor is the forest management area in the whole country.

[3] Since 1995: Bundesanstalt für vereinigungsbedingte Sonderaufgaben (Federal Institute for Special Tasks Arising from Unification)

Ownership size classes

1 = up to 20 ha
11 = up to 5 ha
111 = up to 1 ha
112 = >1 to 5 ha
12 = >5 to 10 ha
13 >10 to 20 ha
2 = >20 to 50 ha
21 = >20 to 30 ha
22 = >30 to 50 ha
3 = >50 to 100 ha
4 = >100 to 200 ha
5 = >200 to 500 ha
6 = >500 to 1,000 ha
7 = >1,000 ha

The use of the multi-digit codes is optional. This is determined uniformly for each *Land*. The primary shorter code numbers may not be used in this case.

The following codes are used in the *Länder*:

HE, RP, SL 1 / 2 / 3 / 4 / 5 / 6 / 7
SN, ST, TH 111 / 112 / 12 / 13 / 2 / 3 / 4 / 5 / 6 / 7
BY, HB, HH, NI, NW 111 / 112 / 12 / 13 / 21 / 22 / 3 / 4 / 5 / 6 / 7
BE, BB, BW, SH 11 / 12 / 13 / 2 / 3 / 4 / 5 / 6 / 7
MV 11 / 12 / 13 / 21 / 22 / 3 / 4 / 5 / 6 / 7

3.2.4 Restrictions on use

Restrictions on use exist if the possible uses of timber cannot all be taken advantage of.

This includes restrictions on the use of timber both due to legal regulations or other external reasons. The reason for such restrictions is indicated.

Restrictions on use

0 = no restriction on the use of timber
2 = use of timber not authorised or not to be expected
3 = approx. 1/3 of the usual harvest to be expected
4 = approx. 2/3 of the usual harvest to be expected

External reasons for the restriction on use

0 = no external restrictions on use
1 = nature conservation
2 = protection forest
3 = recreational forest
9 = other external reasons

In case of several external reasons, indicate the most important reason.

Internal reasons for the restrictions on use

0 = no internal restrictions on use
1 = splitted ownership of uneconomic size (e.g. if the system of land tenure provided for the equal division of land among all qualified heirs)
2 = stand-alone location
3 = insufficient accessibility
4 = site characteristics, wet location
5 = little expected yield (mean total increment < 1 m^3/a*ha)
6 = areas protected at owner's discretion (e.g. natural forest reserves)
9 = other internal reasons

In case of several internal reasons, indicate the most important reason.

Restrictions on use that are only detected during the surveying of the cluster must be entered by the survey team (Chapter 5.4).

3.2.5 Indication of the age on the basis of documents

Only for the first survey: Where documents (including forest management plans) exist, the age of the stand is taken from them and recorded for each species of tree or canopy class. If a tree species occurs in several age groups, multiple entries are made. The age indicated is the age reached on the reference date of the inventory (1 October 2012).

3.2.6 Natural altitudinal zone

As a permanent parameter, the natural altitudinal zone need only be recorded during the first survey.

1 = flat
2 = hilly
3 = sub-montane
4 = montane
5 = sub-alpine, high-montane

3.2.7 Natural forest community

As a permanent attribute, the site aspect need only be surveyed during the first survey.

For each forest plot to be recorded for the first time, the natural forest community is taken from the site maps and classified in the list in accordance with **Annex 4**. Where no site maps exist, the *Land* inventory administration derives a proposal for the natural forest community from relevant documents (general maps showing potential natural vegetation, topographic map, geological map, soil map, regional/local vegetation maps). This proposal is examined by the survey team on site and corrected if necessary (Chapter 5.7.4). The necessary training of the team is carried out by the *Land* inventory administration. The natural forest community is reviewed in particular if the forest habitat type derived from it (**Annex 5**) is not plausible.

3.2.8 Change in the type of land use

In the case of non-forest plots that used to be forest plots during the NFI 2002 survey, the current type of land use is entered, whereas in the

case of forest plots that used to be non-forest plots during the NFI 2002 survey, the former type of land use is entered.

Settlement areas
11 = industrial, commercial and traffic areas, including vegetation-covered slopes along the traffic areas
12 = built-up, sealed off areas not assigned to any other category (e.g. housing estate)
13 = mining sites, landfills, dumps, open areas with no or little vegetation (areas that naturally have these surfaces are in their terminal stage and do not become forest. The existing rare cases are assigned to this category as they often originate from this use of land)
14 = urban green, other unsealed areas, sport and recreation areas
Agricultural areas
21 = arable land
22 = permanent crops (vines, fruit stands, hops, tree nurseries not belonging to the forest)
23 = permanent grassland (pastures, meadows, natural grassland, heaths, transitional stages between forest and shrubs)
Other areas
3 = wetlands
4 = bodies of water
Errors
90 = plot was already clearly non-forest before (missing or wrong designation in NFI 2002)
99 = plot was already clearly forest before (missing or wrong designation in NFI 2002)
Changes in the type of land use that are only detected during the surveying of the cluster must be entered by the survey team

3.2.9 FFH area

The following data on FFH areas are preallocated by the national inventory administration in accordance with the standard data sheet for plots and are controlled and, if necessary, corrected by the *Land* inventory administrations: 1.2 code, 1.7 area name.

Plots located outside FFH areas are preallocated with "0".

3.2.10 Forest habitat type

In order to support the field survey, the forest habitat type can be indicated when establishing the preliminary details provided that suitable data are available. In this context, the codes from Chapter 5.7.5 are used.

The source is indicated.

1 = deduction from habitat type maps
2 = deduction from biotope maps
3 = deduction from site maps or site parameters
4 = deduction from geological maps
5 = deduction from other maps
6 = according to the natural forest community (preliminary details), it is only possible to choose between one specific forest habitat type and no forest habitat type
9 = separate visual inspection by experts

4 Laying out the cluster on site

4.1 Locating the cluster

First survey	Repeat survey
The cluster is transferred to the site by first locating the most accessible plot from a starting point that is clearly identifiable in nature and from the base map (e.g. boundary stone, road junction, parcel corner). From this point, work is continued according to the specified cluster structure to the other plots. The starting point is documented in a sketch and the locating of the plots is evidenced in the survey locating record.	To find the cluster, it is recommended to first go to the starting point established during a former survey. Then, the first plot is located with the help of the survey locating record and the cluster and angle-count sampling sketches of the previous survey, and – where necessary – the marker (Chapter 4.2) is located with the metal detector. From this point, work is continued according to the specified cluster structure to the other plots.
In the case of full clusters (all four plots in the forest), the measurement is continued from the last plot located to the first plot for control purposes. In this context, the following divergences between the end point of the cluster boundary and the starting plot are tolerated:	If the starting point of the previous survey cannot be found or if it appears more favourable to locate the cluster in another order, a new starting point for locating the plot and searching its marker is determined.

- under normal (easy) conditions: 5 m
- under difficult conditions: 10 m
- under very difficult conditions (extremely steep slopes): 20 m.

If these tolerance limits are exceeded, the cluster must be located again.

Alternatively, the given coordinate can be located with a GNNS (Global Navigation Satellite System) device on the site.

If the plot marker cannot be found again but its location can be clearly reconstructed with the help of the angle-count sampling sketch, a new marker is set.

If a cluster or a plot cannot be found at all, the reasons are to be discussed with the *Land* inventory administration for each individual case and the relevant points are to be located anew.

Alternatively, the given coordinate can be located with a GNNS (Global Navigation Satellite System) device on the site.

If a GNSS device is used, a prominent landmark (Chapter 4.3) is indicated and recorded in the base map for at least one plot. This will ensure that the cluster is found again if there are doubts about the accuracy of the GNSS measurement.

In addition, current aerial photographs can be used to help find the cluster.

Measure all distances horizontally.

The azimuth to the object to be located is always indicated. When locating the plot, the measurement is taken from the starting point to the plot; when locating a sample tree, on the other hand, the measurement is taken from the plot to the tree.

If there are obstacles on the cluster boundary, the next plot can also be surveyed with the help of a polygonal chain.

Polygonal chains can be calculated with a tool integrated in the data collection programme.

The starting point serves the long-term safeguarding of the sample point. As a prominent landmark, it is clearly described and easy to find on the

maps, on site and in the team documents. The selection of a suitable starting point has considerable influence on the effort needed to locate the cluster – for both the present and future inventories. The starting point should be permanent, unambiguous and close to a plot. During the first survey of a cluster, the starting point is marked on the base plan and shown and sketched in the survey locating record (e.g. on the form *'Trakteinmessung TE'*).

During the first survey, it is advisable to first locate all the plots and only start with the data collection if the authorised divergence limits in closing the cluster (from the last to the first plot) are not exceeded.

If an electronic range finder is used to locate the cluster, it is calibrated both daily and before each cluster survey according to the instruction manual.

If in a sloping site the horizontal distance cannot be determined automatically with the range finder, the distances measured on the slope are converted using the reduction factors in **Annex 10**.

The *Land* inventory administrations send copies of the base maps of all forest clusters and copies of the survey locating record in electronic form to the national inventory administration for archiving.

4.2 Marking the plots

First survey	Repeat survey
The plots situated in the forest are marked by angle sections (Chapter 1.10) which are lowered into the ground. If the marker cannot be lowered into the ground (e.g. rock, stream bed), a substitute point is marked and documented (azimuth, horizontal distance).	All plots surveyed within the scope of the previous inventories are marked by a metal rod with round profile (NFI 1987) or T profile (NFI 2002) which has been lowered into the ground or by another hidden marker. Where the marker could not be lowered into the ground (e.g. rock, stream bed), a substitute point was marked and recorded in the form 'Trakteinmessung'.

If a marker cannot be found again or is no longer suitable as a permanent marker, this is noted and the plot is marked anew just like in the first survey.

An intact marker is left unchanged.

Marking the plot

0 = marker not sought / not found because plot is now in non-forest
1 = old marker found again
2 = old marker not found again or unsuitable, but plot and sample trees clearly identified; new marker in place
3 = marker placed for the first time
4 = old plot and sample trees not found again, plot surveyed anew, new marker in place

The type of the found or new marker is indicated.
If a prominent landmark is situated near the plot (e.g. boundary stone, crossroads), this landmark is located with its polar coordinate (azimuth, horizontal distance) as an additional reference point to facilitate the finding of the plot at a later stage.

For control purposes (Chapter 1.9), the plot is marked temporarily (Chapter 5.5.2).

As temporary marking of the plot, the sample tree closest to the plot is marked with its sample tree number according to the requirements of the *Land* inventory administration.

4.3 Determination of the plot coordinates with GNSS

The following minimum standards are recommended with regard to determining the coordinates of the accessible forest plots with a GNSS device:

Criterion	Good	Suitable	Not suitable; must be repeated
HDOP	≤3	> 3 and ≤ 8	> 8
PDOP	≤ 3	> 3 and ≤ 8	> 8
Number of measurements	100	60-99	0-59
Duration of individual measurement [seconds/measurement] *	≤ 2	> 2 and ≤ 10	> 10
Correction signal	Existent	Non-existent	
Age of the correction signal [minutes]**	≤ 15		> 15
Number of satellites if only GPS or only GLONASS	≥ 4		< 4
Number of satellites in the case of combined use of GPS and GLONASS	≥ 5		< 5
Elevation angle**	≥ 10		< 10
SNR (signal noise ratio, signal strength)	According to the manufacturer recommendation		
Motionless positioning on the measuring point before the beginning of the measurement	30 seconds		
Updating the almanac	Lock onto the satellites for 15 minutes prior to the first measurement if the last measurement was more than two days ago or over 500 km away		

* If signal frequency = one measured value per second

** Recommended configuration value

Store the data in the database.

The measurement can be aborted after twenty minutes in case of unfavourable reception conditions.

The measurement must be repeated if no suitable value could be gained for a certain criterion. It is recommended to repeat the measurement if all values measured can only be assessed as 'suitable'.

If the plot cannot be located with the help of GNSS, a staggered auxiliary point can be located by GNSS measurements. A compass traverse is made from the auxiliary point to the plot. The course is shown on the navigation surface simultaneously with the data entry. The coordinate of the plot is calculated from the GNSS coordinate of the auxiliary point and the compass traverse.

As for determining the position of the auxiliary point, the same minimum standards apply as for the measurement of the plot coordinates.

4.4 Locating the sample circles

The sample circles with a radius of 1 m or 2 m are located 5 m north of the plot (horizontal distance). If they are not entirely in the same stand as the plot or if they are divided by a wildlife fence, the centre is shifted not to the north but to the south. If it is not in the same stand there either, then it is shifted to the east or finally to the west. If none of these provisions prove successful, the distance is shortened and the direction that allows for the greatest distance is chosen. The position is indicated. The centre of the sample circle is marked by a ranging pole for the time of the survey.

All other sample circles are centred exactly on the plot marker.

Sample circle radii are measured as horizontal distances. A suitable range finder is used for this purpose, or a measuring tape or measuring stick is held horizontally.

5 Surveying the cluster

5.1 Accessibility

Accessible plots are located and surveyed. For inaccessible plots, only the data recognisable from a distance are recorded.

Temporarily inaccessible plots are to be surveyed at a later date, if possible. Sample points that are temporarily inaccessible due to storm damage should be surveyed as soon as investigations are completed, where possible.

1 = accessible
2 = inaccessible, entry prohibited
3 = inaccessible, dangerous site conditions (e.g. mountain, bog, water)
4 = inaccessible, other dangers
5 = inaccessible, mountain pines or other impenetrable vegetation

5.2 Forest/non-forest

After a plot has been located, it is first established whether it is in the forest or not.

Forest within the meaning of the NFI is any area of ground covered by forest vegetation, irrespective of the information in the cadastre or similar records. The term forest also refers to cutover or thinned areas, forest tracks, firebreaks, temporarily unstocked land and clearings, forest glades, feeding grounds for game, landings, forest aisles, further areas linked to and serving the forest including areas with recreation facilities, overgrown heaths and moorland, overgrown former pastures, alpine pastures and rough pastures, as well as areas of dwarf pines and green alders. Heaths, moorland, pastures, alpine pastures and rough pastures are considered to be overgrown if the natural forest cover has reached an average age of five years and if at least 50% of the area is covered by forest.

Areas with forest cover in open pasture land or in built-up areas of under 1000 m², coppices under 10 m wide, Christmas tree and ornamental brushwood plantations, commercial forest-tree nurseries as well as parkland attached to country houses are not forest within the meaning of the NFI. Watercourses up to 5 m wide do not break the continuity of a forest area.

Christmas tree and ornamental brushwood plantations in the forest are considered forest within the meaning of the NFI.

Forest/non-forest

0 = non-forest
3 = forest, temporarily unstocked land
4 = forest, unstocked forest land
5 = forest, stocked timberland
8 = irrelevant, because outside of inventory territory
9 = irrelevant, because not belonging to the grid-size area

Temporarily unstocked areas are areas of timberland that are temporarily without forest cover.

Unstocked forest land includes forest tracks*, forest aisles** over 5 m wide, landings, non-commercial forest-tree nurseries belonging to the forest, seed and plant nurseries, food plots and meadows, yard and building areas used for forestry purposes, recreational facilities linked to the forest as well as rocks, boulders, gravel and water located in the forest. Swamps and moors located in the forest are also considered unstocked forest land provided that they are not overgrown.

* When determining the width of the track for the identification of unstocked forest land, verges and ditches on both sides are included in the measurement, but not adjacent slopes.

** The measurement of the width of the aisle is made from tree to tree at root collar level, deducting 3 m on each side as belonging to the respective stand. A forest aisle is therefore also regarded as unstocked forest land if the distance from tree to tree at root collar level is greater than 11 m. The borders of the unstocked forest land are in these cases to be established at a distance of 3 m each from the trees on the edge at root collar level.

On unstocked forest land, only particularly protected forest biotopes (Chapter 5.7.3) are recorded.

Further surveys are only carried out in the forest (timberland, including temporarily unstocked areas).

Changes in the type of land use

In the case of non-forest plots that used to be forest plots during the previous survey, the current type of land use is entered, whereas in the case of forest plots that used to be non-forest plots during the previous survey, the former type of land use is entered. The preliminary details established at the beginning are checked (Chapter 3.2.8).

5.3 Management type

Management type

1 = high forest
2 = plenter forest
3 = composite forest
4 = coppice forest
5 = short-rotation plantation

The information is cited for the stand in which the plot is located.

High forest is a forest developing from plantation or grown from seedlings or a forest from coppice stand or suckers that is not considered coppice forest because of its age (>40 years). In the high forest, entire stands or parts of a stand are exploited through clearing or during a period of regeneration.

Plenter forest is a form of high forest in which trees of different ages and different dimensions (height, diameter) are mixed in small aggregations and over a long period of time.

Coppice forest is a forest from coppice shoots or suckers of up to 40 years of age.

Composite forest is a hybrid formed from coppice forest and high forest, with an overstorey (standards) of grown coppice stands and trees grown from seedlings and an understorey grown from coppice shoot, suckers and seedlings.

Short-rotation plantations are areas that are exclusively stocked with fast-growing tree species and are managed with rotation periods of up to 20 years. Due to their growth behaviour and their structure, historic land management systems such as coppice or composite forests are not included.

5.4 Timber harvesting conditions

0 = suitable for all timber harvesting methods, e. g.
- flat to sloping sites (< 30% [17°] slope gradient),
- no extremely soft soils,

1 = highly mechanised methods only possible with slope harvester/slope forwarder, e.g.
- sloping to steep sites (30 – 55% [17° – 29°] slope gradient)

- no/few rock piles, spring horizons, slope ruptures,
- bank gradient (transition road/extraction track) < 60% [31°],
- extraction tracks at a distance of 40 m along the line of greatest slope

2 = not suitable for harvesters, but no cable-crane site, e. g.
- sloping to steep sites (30 – 50 % [17° – 27°] slope gradient),
- rock piles, spring horizons, slope ruptures,
- skidding road existing,

3 = cable crane required, e. g.
- extremely soft soil situations at any slope gradient,
- steep slope > 50 % [27°] slope gradient,
- rock piles, spring horizons, slope ruptures,
- lacking or insufficient skidding roads (distances > 150 m),
- forest or skidding road existing at both the top and the bottom of the slope

4 = timber harvesting unlikely due to considerable difficulties, e. g.
- lacking or insufficient extraction tracks or skidding roads (distances > 150 m),
- extremely long skidding distances (distance from the felling site to the next road > 1 km) or lacking connection
- steep slopes > 50 (55)% [27° (29°)] slope gradient without forest or skidding roads at the top and the bottom of the slope

The timber harvesting conditions are indicated irrespective of possible restrictions on use (Chapter 3.2.4). Restrictions on use under Chapter 3.2.4 that are only detected on site must be indicated.

5.5 Sample trees from 7 cm diameter at breast height (DBH)

5.5.1 Selection by means of angle-count sampling

5.5.1.1 Principles

The sample trees from 7 cm diameter at breast height (DBH) are selected by way of an angle-count sampling with basal area factor 4 on each forest plot. This angle-count sampling is also carried out on temporarily unstocked areas, but not on unstocked forest land. Fallen trees are also taken into account if they meet the conditions mentioned below. Stand edges are not taken into account.

The survey is carried out with the Relascope. As a rule, this Relascope must be located precisely on the plot. For this purpose, the Relascope is placed next to the ranging pole driven onto the plot. It is moved to the side if vision is restricted by obstructions that cannot be removed easily. In this case, the distance to the targeted tree must not change, however. As a matter of principle, the observations with the Relascope are carried out with the weighted wheel released. In case of leaning trees, the Relascope is also inclined accordingly.

Every living tree and every tree that probably died less than 12 months ago with a DBH of 7 cm or more, the DBH of which appears wider than the scale for basal area factor 4 in the Relascope (as regards the Bitterlich-Spiegelrelaskop: a white band and four narrow alternating black and white bands) or which passes the borderline tree check is selected as a sample tree (see Figure 8 in the Annex).

In case of doubt, a borderline tree check must be carried out (see Chapter 5.5.1.2).

All sample trees recorded in the previous survey must be identified. The whereabouts of sample trees no longer in existence must be documented (Chapter 5.5.3).
Tree species, azimuth and distance, as well as the age of the tree extrapolated from the previous inventory are checked and, if necessary, corrected.

5.5.1.2 Borderline tree check

A borderline tree check is carried out if the Relascope observations cannot clearly determine whether a tree is a sample tree or not. With regard to the Bitterlich-Spiegelrelaskop it can be said: left edge of the tree in the area of the two points.

In this context, it is checked whether the centre of the angle-count sampling lies within the limit circle of the tree to be controlled. This is the case if the horizontal distance is ≤ 25 times the breast-height diameter (or if the horizontal distance in m is ≤ ¼ of the breast-height diameter in cm).

As described in Chapter 5.5.6, the horizontal distance must be measured to 1 cm accuracy.

For the trees recorded, the borderline tree check is carried out automatically during the data validation process with the mobile data collection device (MDE). In this context, the diameter converted to 1.3 m measuring height is used if the DBH was measured at another height.

5.5.1.3 Angle-count sampling at the stand edge

Whether a tree belongs to a stand or not has no influence on whether a tree is recorded with the help of angle-count sampling. Only trees located behind unstocked forest land or non-forest are not included.

With respect to sample trees in the vicinity of the stand edge, it is to be determined which part of their marginal circle lies within the stand in order to make the data comparable to former surveys. To this end, forest edges or stand boundaries are located if their distance from the sample tree is less than 25 times the breast-height diameter and their distance from the sampling point is less than 25 m. If correct data are available from the NFI 2002, the edges do not have to be located again.

Further details with regard locating stand edges are provided in Chapter 5.10.1.

5.5.2 Sample tree number

Every sample tree is assigned a tree number with which it can be clearly identified within the scope of the angle-count sampling. Forks developing below breast height (1.3 m) are recorded as two separate trees.

First survey	Repeat survey
The sample tree closest to the centre of the angle-count sampling is recorded first. The survey is then continued clockwise. The sample trees are numbered in the order in which they are recorded, starting with 1.	The tree numbers allocated during previous surveys (including sample tree code number = 8 if DBH was measured) are retained. The counting of the newly recorded sample trees starts with the next free number that is assigned by the survey software. The survey is conducted clockwise.

It is recommended to temporarily identify the sample trees during the survey. The sample tree standing closest to the plot is marked temporarily for control purposes (Chapter 1.9).

5.5.3 Sample tree code number

0 = new sample tree
1 = re-surveyed sample tree from the previous inventory
2 = sample tree from the previous inventory that has been selectively removed
3 = sample tree from the previous inventory that has been removed though clear-cutting
4 = sample tree from the previous inventory that is no longer standing but obviously not intended for removal (possibly deadwood; Chapter 5.9.1)
5 = sample tree from the previous inventory that probably died more than twelve months ago (e. g. without fine branch structure), no sample tree of the current inventory, possibly deadwood (Chapter 5.9.1)
8 = invalid sample tree because horizontal distance is greater than the marginal circle radius

9 = sample tree from the previous inventory that can no longer be found, not even as a stump[4]
10 = tree still existing but no longer a sample tree
11 = cut tree outside the sample
1111 = tree marked for the inventory but not belonging to the sample trees

Further information is given only for trees with sample tree code number 0 or 1.

Sample tree code number 4 refers to trees that were cut down or have fallen over but must not be classified as intended for removal. This does not include recently felled trees that are obviously intended for extraction.

Before the code number "can no longer be found" (9) is assigned, it has to be thoroughly checked whether it is possible that the coordinates are wrong and a corresponding, unsurveyed tree can be found somewhere else.

Above all, it is to be checked whether the sample tree can be found with an azimuth reduced by 200 gon. This error occurs if the measurement during a previous survey was mistakenly not carried out from the plot to the tree but in the opposite direction.

The distinction between "removed" (code number =2 or =3) and "no longer standing" (code number = 4) sample trees is important to calculate the quantity of the timber harvest. In the case of "removed" sample trees, it is assumed that they have been or will be used. They are therefore to be taken into account in the calculation of the timber harvest. "No longer standing" sample trees, on the other hand, are not taken into account in the calculation of the timber harvest.

[4] The following code numbers are contained in the data but are not assigned within the scope of the survey:
2002, 2007, 2008 = sample tree sorted out during a previous survey (year)

A sample tree is considered "removed" (code number =2 or =3) if the trunk is no longer – neither standing nor lying – in its former place so that it can be assumed that it was extracted. Furthermore, recently felled sample trees that are obviously intended for extraction are also considered "removed".

In contrast to this, code number = 4 is assigned if the sample tree has fallen and is lying in the vicinity of its former location. Moreover, code number =4 is assigned to sample trees that were felled some time ago but have not been extracted so that it can hardly be expected that they will in fact be used.

If a part of the tree has been "removed" and another part of it is still lying in the vicinity of its former location, the code number is assigned according to the whereabouts of the main part of the trunk.

Sample tree code number = 3 is always to be assigned if all trees in the vicinity of the plot have been eliminated since the previous survey and there is no sample tree anymore. Accordingly, code number =2 is assigned if individual trees have been removed while others remained.

Code number =10 is assigned, for instance, to sample trees from a former survey that have remained at a plot that has become non-forest.

If a tree marked for the NFI (1111) has grown into the sampling range and has thus become a sample tree, the marking must be deleted and the code number must be changed to 0.

With regard to newly recorded sample trees, it must be indicated whether they belong to the stand in which the plot is located.

Affiliation to the stand

0 = tree does not belong to the stand in which the plot is located
1 = tree belongs to the stand in which the plot is located

5.5.4 Tree species

10 European spruce	150 Native lime trees (*Tilia cordata, T. platyphyllos, T. x. hollandica*)
12 Sitka spruce	160 Robinia
19 Other spruces	170 Native elms (*Ulmus glabra, U. minor, U. x. hollandica; U. laevis*)
20 Common pine	181 Sweet chestnut
21 Mountain pine	190 Other deciduous trees with a long life expectancy
22 European black pine	191 Service tree
24 Swiss pine	193 Whitebeam
25 Weymouth pine	200 European white birch
29 Other pines	201 *Betula pubescens ssp. pubescens* + *Betula pubescens ssp. carpatica*
30 European silver fir	211 Black alder
33 Grand fir	212 White alder, grey alder
39 Other firs	220 Aspen
40 Douglas fir	221 European black poplar
50 European larch	222 Grey poplar
51 Japanese larch (+hybr.)	223 Silver-leaf poplar, white poplar
90 Other conifers	224 Balsam poplar (+hybrids)
94 Yew	230 Rowan tree
100 European beech	240 Native willows (*S. aurita, S. caprea, S. alba, S. fragilis, S. x. rubes, S. eleagnos*)
110 Common oak	250 Bird-cherry
111 Sessile oak	251 Wild cherry
112 Northern red oak	252 Black cherry
120 European ash	290 Other deciduous trees with a short life expectancy
130 European hornbeam	292 Wild apple
140 Sycamore maple	293 Wild pear
141 Norway maple	295 Wild service tree
142 Field maple	

Alphabetic tree species lists can be found in **Annex 13**.

The data from the NFI 2002 must be checked and, if necessary, corrected. In the *Länder* BB, BE, BW, HE, RP, SL, SN and TH, where relevant, the following tree species are to be specified in more detail for sample trees from the NFI 2002: 12 Sitka spruce (used to be 19, other spruces), 25 Weymouth pine (used to be 29, other pines), 33 grand fir (used to be 39, other firs), 211 black alder and 212 white alder (used to be 210, alder).

Annex 7 contains information on the distinction between English oak and sessile oak, **Annex 8** contains information on the distinction between European white birch and Betula pubescens (incl. *Betula pubescens var. glabrata*), and **Annex 9** contains information on the distinction between the various poplar tree species.

5.5.5 Azimuth

First survey	Repeat survey
The angle between the line from the angle-count sampling centre to the sample tree and magnetic north is measured in gon. The magnetic deviation is not taken into account in this context.	The data for NFI 2002 sample trees that have been found again are corrected if the view in the direction indicated does not line up with the tree trunk.

In this process, aim is taken at the perpendicular axis through the cross-section at breast height, just like when measuring the horizontal distance.

5.5.6 Horizontal distance

First survey	Repeat survey
The horizontal distance from the angle-count sampling centre to the sample tree is measured in cm.	The data for NFI 2002 sample trees that have been found again are corrected if a divergence of over ½ DBH is detected. If a borderline tree check is required (Chapter 5.5.1.2), a divergence

of $^{1}/_{10}$ DBH is tolerated.

The measuring point on the tree is determined by the perpendicular axis through the cross-section at breast height. Alternatively, the point of contact of a tangent running through the plot to the trunk at a height of 1.30 m can also serve as measuring point. For trees that in the Relascope observations are incontestably identified as sample trees, the indication of the horizontal distance to the nearest 10 cm suffices.
The measured slope distances in an inclined site are converted using the reduction factors in **Annex 10** if the horizontal distance cannot be ascertained automatically with an appropriate measuring instrument.

5.5.7 Canopy class

Every tree is assigned to a canopy class. If the sample covers trees from different stands, the canopy classes are determined separately for each stand.

The **canopy classes** form the vertical configuration of the stand. Within a canopy class, the trees have their crown area at the same height above the ground. Different canopy classes of a stand have no contact with one another in the crown area.

The **main stand** is the canopy class where the main economic focus lies. If the degree of coverage of the highest canopy class is at least 5/10, this canopy class is always considered the main stand.

The **understorey** is the canopy class below the main stand.

The **upper storey** is the canopy class above the main stand.

Canopy class

0 = no assignment possible (plenter forest)
1 = main stand
2 = understorey
3 = upper storey
9 = lying tree

5.5.8 Diameter at breast height

The diameter at breast height is measured with the girth tape to the nearest mm. The measurement is made at right angles to the trunk axis. The measuring tape must be pulled tightly. Loose pieces of bark, lichen, moss, etc. are removed.

This breast height is determined with the help of a height stick. For this purpose, the stick is set firmly on the ground so that humus layer and ground vegetation are compressed (foot). In the case of swellings of the trunk at breast height, the measurement is taken above or below the swelling. The measuring height is recorded. It must lie between 0.5 m and 2.5 m in height. As a matter of principle, the measuring height of the previous inventory must be used for the new measurement. Trees that have forked below breast height (1.30 m) are recorded as two separate trees.

The **fork** begins where the pith divides.

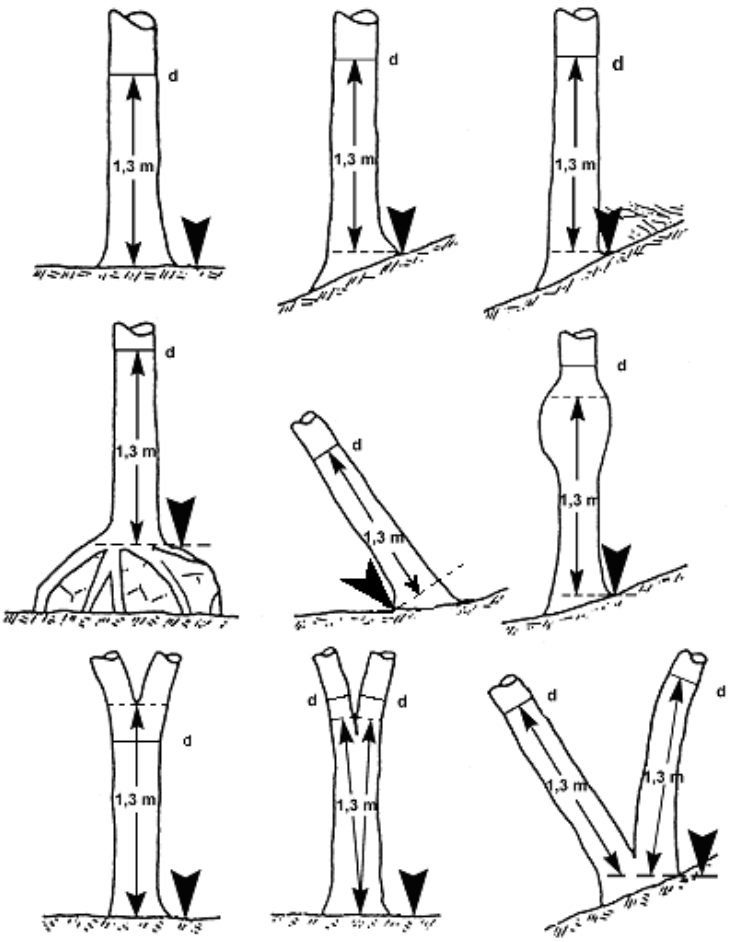


Figure 3: Definition of breast height and position for diameter measurement at breast height[5]

In level sites, the foot for the measuring height of the diameter at breast height is established in the direction of the sampling centre.

If a different measuring height is recorded from a previous inventory, the measurement is taken at the same height again, if possible.

5.5.9 Tree class

The social position and crown formation of each sample tree in the main stand is assessed according to KRAFT:

[5] Zöhrer S.: Forstinventur. Ein Leitfaden für Studium und Praxis. Pareys Studientexte 26. 1980 S. 126 (geändert: 2. Reihe Mitte. 3. Reihe links und Mitte).

Tree class

0 = not main stand
1 = predominant tree
2 = dominant tree
3 = subdominant tree
4 = suppressed tree

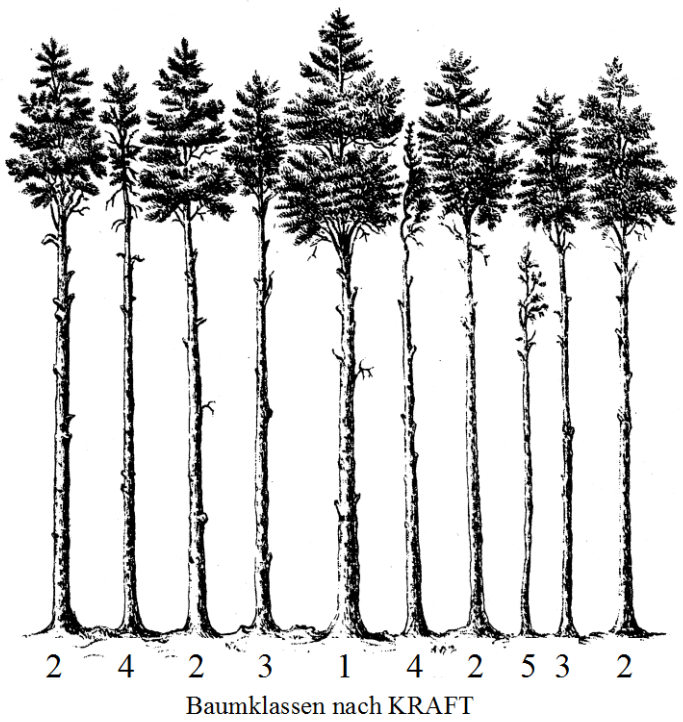


Figure 4: Tree classes according to KRAFT

Tree class = 5 is not used as these trees do not belong to the main stand. The tree is assigned to tree class = 0 and canopy class = 2 (understorey).

5.5.10 Tree age

The age of the tree indicates the number of calendar years since the germination of the seeds and/or the rooting of the nursery plant. The age at the reference date of the inventory (1 October 2012) is recorded.

First survey	Repeat survey
The age of the tree is taken from the preliminary data of the cluster established before the actual survey, provided that this is not obviously	The age of the tree is extrapolated from the previous inventory. This information is corrected if the visual estimate of age suggests a

inconsistent with the real age of the tree. If the preliminary details of the cluster contain a false age or no age at all, the annual growth rings on stumps or the number of branch whorls are counted. Alternatively, the age is estimated on the basis of the local growth dynamics. With the consent of the forest owner, an increment borer may also be used. These samples must not be taken at breast height, however.

considerably different age (>1/3 of the indicated age).

The age of new sample trees is estimated on the basis of the existing age information for the relevant plot (tree age or stand age).

The way in which the age was determined must be indicated.

Determination of age

1 = information taken from the preliminary details of the cluster
2 = age determined from stumps
3 = count of branch whorls
4 = age determined by increment borer
5 = estimate
6 = age extrapolated from previous inventory
7 = same as the age of the forest cover
8 = same as the other trees of the stand

5.5.11 Tree height

To measure the height, clearly observable sample trees from the angle-count sampling (basal area factor 4) are selected from the medium to large diameter range on every plot in each stand and in each canopy class. Trees measured in the scope of previous inventories should be measured anew, if possible. These trees are marked in the data collection programs.

Main stand	two trees of the most prevalent group of tree species* and one tree of every other occurring group of tree species*
Upper storey	one tree of every occurring group of tree species*
Understorey	one coniferous and one deciduous tree (if available)

* Spruce, fir, Douglas fir, pine, larch, oak, beech.
All other coniferous trees are classified as firs and all other deciduous trees are classified as beeches.

Trees with broken crowns or broken tops, forked trees and trees without a pronounced single trunk, as well as leaning, crooked or dead trees are excluded.

Trees to be excluded from measuring under the above sentence should nevertheless be measured if there is no better suitable tree available for such height measurement.

The *Land* inventory administrations may stipulate that further tree heights are measured.

In plenter forests, all tree heights are measured.

The tree height is measured as the length from the foot (Chapter 5.5.8) to the top with the range-finder to the nearest dm. **Annex 11** contains further information on leaning trees.

On steeper ground, the height should be measured parallel to the slope, if possible. In the case of deciduous trees, special care is to be taken that the crown is not aimed tangentially but that the ideal piercing point of the trunk axis with the crown is to be aimed at.

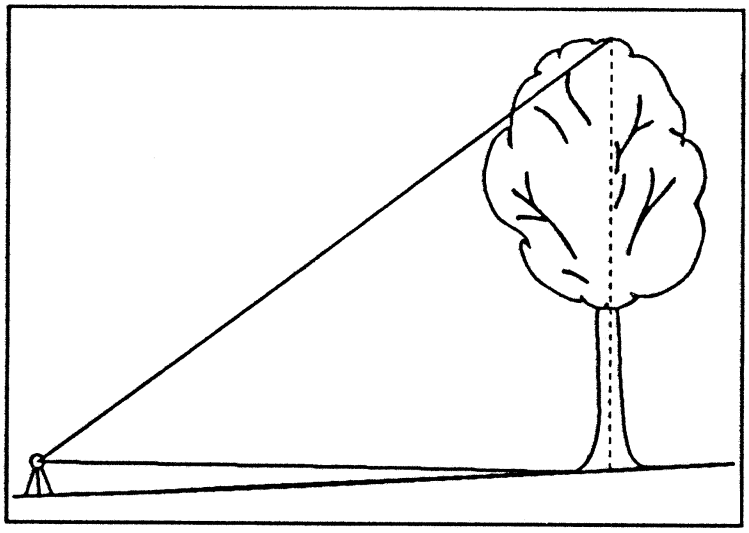


Figure 5: Sighting of the crown to measure the height

5.5.12 Stem height

The following *Länder* measure the stem height: BW, BY, MV, NW, RP, SH, SL, TH.

The following *Länder* do not measure the stem height: BB, BE, HB, HE, HH, NI, SN, ST.

The stem height is measure in dm. It is measured at least on all deciduous trees ≥ 20 cm DBH, the height of which is also measured. The selection criteria for tree height mentioned in Chapter 5.5.11 apply. Trees the trunks of which are extended into the crown layer (Chapter 5.5.15 Number 1) are not measured.

The stem height is measured at the point where the shaft, which is sawable due to its form, ends.

If the diameter decreases significantly along the trunk due to a strong branch (including dead branches), the stem height is measured up to the beginning of this branch (cf. Figure 6)

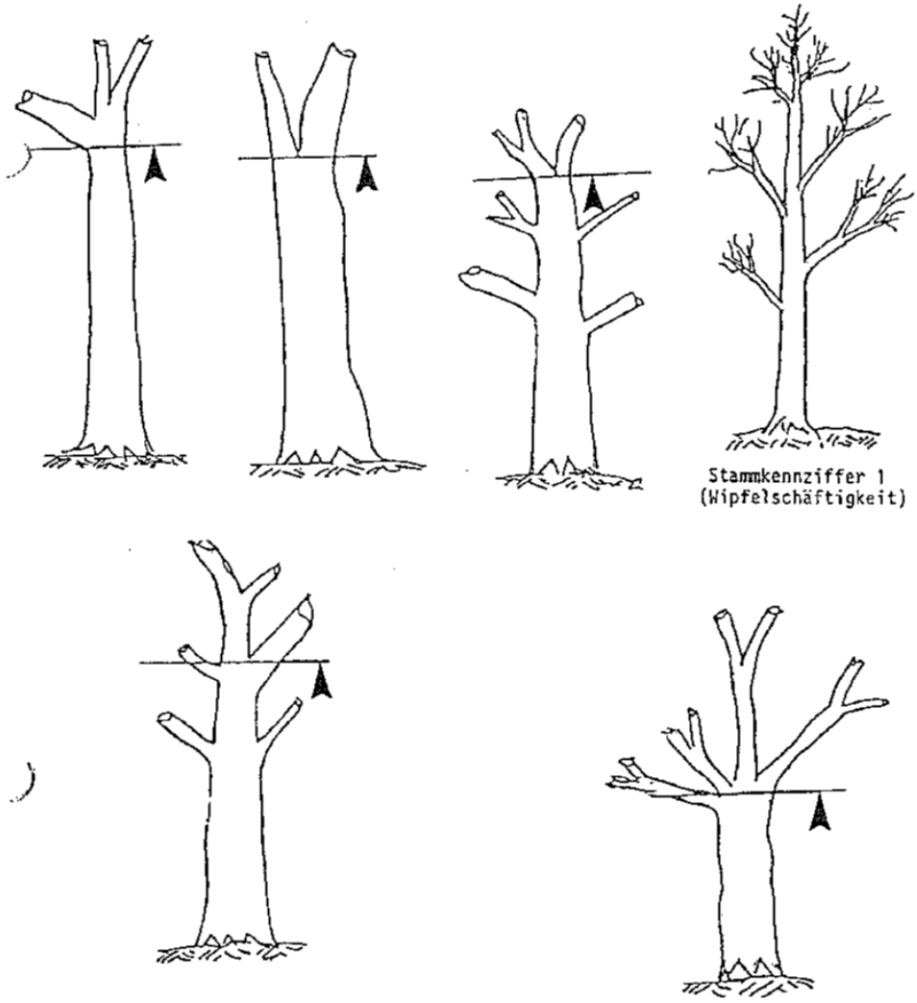


Figure 6: Measuring point for stem height (deciduous trees)

5.5.13 Upper diameter

It is up to the *Länder* whether the upper diameter is measured or not.

It is measured in the following *Länder*: BW, BY, HE, MV, NW, RP, SH, SL, SN, ST, TH

The following *Länder* do not measure the upper diameter: BB, BE, HB, HH, NI

For all height-measurement trees, the upper stem diameter is preferably measured at 30% of the tree height (as indicated by the MDE), in any case in the range between 30% of the tree height and 7 m in height. The measuring height is indicated in dm.

The upper diameter of trees with trunk code number 2 or 3 (Chapter 5.5.15, forked tree or no pronounced trunk) is not measured.

The upper diameter is measured to the nearest 0.5 cm. In level sites, the measurement is made from the direction of the centre point of the angle-count sampling. In sloping sites, the callipers are set from the upper slope at the same foot as that used to determine the breast height (1.30 m) (Figure 3).

The information in **Annex 14** (Figure 9 and Figure 10) is taken into account when measuring the upper diameter.

5.5.14 Height code number

0 = no shaft breakage
1 = top breakage (estimated length of broken part up to 3 m)
2 = crown breakage (estimated length of broken part over 3 m)

A healed top breakage or crown breakage where the broken length has been replaced by a new shoot is not indicated.

5.5.15 Trunk code number

0 = disintegration of the shaft below a height of 70% of the tree height
1 = continuous shaft up to the top (trunk extending into the crown layer); continuous shaft ≥ 70% of the tree height
2 = fork between breast height and 7 m of height
3 = no pronounced single trunk, foot to crown base < 3 m

5.5.16 Trees with special attributes

The following attributes are indicated for each sample tree as "present" (=1) or "not present" (=0):

- bark-peeling damage in the last 12 months
- bark-peeling damage older than 12 months
- skidding or felling damage
- resin streaks (commercial resin harvesting)
- beetle damage in the surface of the trunk
- probably died less than 12 months ago (e.g. fine brushwood still present)

- fungal infection
  with large fungal bodies such as fungi fruiting bodies, etc.
- special habitat tree attributes,
  - with stem rot > 500 cm² in the timber body or
  - with loosening bark or bark pockets > 500 cm², 10 cm minimum width, or
  - with rotten or rotting trunk injury or
  - with wood mould hollows large enough for a forearm or
  - slime or sap bleeding longer than 50 cm on deciduous trees
- eyrie tree
  trees with medium-sized or large eyrie, which is often populated over many years thus excluding exploitation of the trees in the medium term (at least 50 cm estimated eyrie diameter or at least buzzard nest size)
- hollow tree
  at least one cavity made by woodpeckers or caused by decomposition of branches
- crown deadwood
  more than one third of the upper crown dead
- other damage from outside influences
- tree marked as biotope tree (*Land*-specific support scheme)

5.5.17 Pruning

The pruning height is indicated as follows:

0 = no pruning
1 = up to 2.5 m
2 = > 2.5 to 5.0 m
3 = > 5.0 m to 7.5 m
4 = > 7.5 m to 10.0 m
5 = > 10.0 m to 15 m
6 = > 15 m

5.6 Sample trees under 7 cm in breast-height diameter

Sample trees under 7 cm in breast-height diameter are counted in sample circles with a radius of 1 m or 2 m the common centre of which is located 5 m north of the plot. If they are not entirely in the same stand or if they are divided by a wildlife fence, the common centre is shifted (Chapter 4.4). The direction from the sampling point to the sample circle is recorded:

1 = north / 2 = south / 3 = east / 4 = west.

The horizontal distance is indicated in cm.

In this context, a distinction is made between tree species, tree size, damage from game and individual protection measures. For each case, the canopy class and the protection by fence are indicated for the entire sample circle.

<table>
<tr><td>Sample trees over 50 cm in height up to 6.9 cm DBH</td><td>Sample trees from 20 cm to 50 cm in height</td></tr>
<tr><td>Sample tree radius = 2 m</td><td>Sample tree radius = 1 m
If there are less than four sample trees in r = 1, the radius is extended to 2 m.</td></tr>
<tr><td>Tree size
1 = > 50 cm to 130 cm in height
2 = > 130 cm in height up to 4.9 cm DBH
5 = 5.0 to 5.9 cm DBH
6 = 6.0 to 6.9 cm DBH</td><td></td></tr>
<tr><td colspan="2">Tree species in accordance with tree species list (Chapter 5.5.4).</td></tr>
<tr><td colspan="2">Browsing
0 = no browsing
1 = simple browsing of the terminal bud within the last 12 months
2 = multiple browsing (also in the case of an intact terminal bud) over a longer period of time (including the last 12 months)</td></tr>
</table>

Sample trees over 50 cm in height up to 6.9 cm DBH	Sample trees from 20 cm to 50 cm in height
Bark-peeling damage 0 = not present 1 = bark-peeling damage of the last 12 months 2 = only older bark-peeling damage	
Individual protection measures 0 = not present / 1 = present	
Protection by fence A fence is also indicated if it is obvious that game can enter. The information is to be given in any case. 0 = not present / 1 = present	
Canopy class (for the entire sample circle) 0 = no assignment possible (plenter forest) 1 = main stand 2 = understorey 4 = regeneration under shelterwood	

The assignment of the sample trees to the sample circle is determined by the point of emergence from the ground. In the case of leaning trees, the indication of height relates to the height of the terminal bud above the ground. In the case of forest from coppice stand, only the strongest shoot from a stump is considered.

5.7 Structural and biotope attributes

5.7.1 Horizontal and vertical structure of the forest cover

Stand edges are not taken into account.

Trees up to 4 m in height	**Trees over 4 m in height**
are included in the sample circle with r = 10 m. Trees under 20 cm in height are not taken into account in this context. The following attributes are indicated:	are recorded by means of angle-count sampling with a basal area factor depending on the number of sample trees in the angle-count sampling with basal area factor 4 (Chapter 5.5.1). In the case of up to

Proportion of tree species***,** estimated in 1/10

Degree of coverage*, estimated in 1/10

* Estimation aid: The degree of coverage and the proportions of tree species are estimated in tenths of the covered 1 m² quadrangles. The 10 m circle has approx. 314 m². If the 10 m circle is divided by a forest edge or a boundary to unstocked forest land, only the timberland part is taken into account.

Layer of forest cover

1 = main forest cover
2 = regeneration

Predominant type of regeneration

1 = natural regeneration
2 = sowing
3 = plantation
4 = coppice stand
5 = classification not possible

ten sample trees with basal area factor 4, basal area factor 1 is used to describe the structure while basal area factor 2 may be used beyond this.

In contrast to the angle-count sampling with basal area factor 4, the selection is made without consideration of a minimum diameter. On forest edges or boundaries to unstocked forest land (apart from forest tracks), a true mirroring is carried out.

The trees are counted by **tree species** and canopy class:

Layer of forest cover

1 = main forest cover
3 = residual forest cover
9 = already taken into account in the 10 m sample circle.

The **basal area factor** (BAF) is indicated.

1 = angle-count sampling with BAF 1
2 = angle-count sampling with BAF 2

Either for trees up to 4 m in height or for trees over 4 m in height, "main forest cover" (layer =1) must be indicated.

The main forest cover is the layer where the economic focus lies. If the degree of coverage of the trees over 4 m in height is at least 5/10, they always form the main forest cover. In this case, "regeneration" (2) is entered for the trees up to 4 m in height.

All trees of a layer the average height of which is ≤ 4 m are taken into account when estimating the degree of coverage and the proportions of tree species in the sample circle with r = 10 m, even if they are insignificantly larger. If such trees are also included in the angle-count sampling 1(2), these trees, instead of the layer, are assigned the comment "already taken into account in the sample circle" (layer = 9). With a view to consistent data collection, the estimate in the 10 m circle must be made before the angle-count sampling 1(2) is conducted.

The type of regeneration must always be indicated for trees up to 4 m in height and not only for layer = 2 (regeneration).

Structure of the forest cover

1 = one layer
2 = two layers
3 = two layers (upper storey: hold-over trees or remnants from former fellings)
4 = two layers (understorey: advance regeneration)
5 = two layers (understorey: underwood)
6 = multiple layers or plenter type.

The indication of the structure relates to the part of the forest cover that is included in the angle-count sampling 1(2) or the sample circle with r = 10 m.

Age

The age reached on the reference date of the inventory (1 October 2012) is entered in years. If the age is derived from different data for various tree species or stands, it is calculated as a proportion-weighted mean. The way in which the age was determined must be indicated.

With the consent of the forest owner, the age can also be determined by increment borer. However, the increment borer must not be used at breast height on the trees of the angle-count sampling.

The following information should be given:

Structure 2: age of the upper storey

Structure 3: age of the main forest cover; the age of the hold-over

	trees and the remnants from former fellings is not indicated
Structure 4:	age of the main forest cover
Structure 5:	age of the main forest cover
Structure 6:	in the case of stands with multiple layers: age of the upper storey; in the case of plenter-type stands: no age
Management type 3: (composite forest, Chapter 5.3).	age of the overstorey

Type of age determination

0 = none (in plenter forest)
1 = information taken from the preliminary details of the cluster
2 = age determined from stumps
3 = count of branch whorls
4 = age determined by increment borer
5 = estimate
6 = age extrapolated from previous inventory
8 = same as the other trees of the stand

Forest development phase

A forest development phase is a stage of forest development in which the forest trees have a certain dimension. The indication refers to the part of the forest cover for which the age is indicated, in plenter forest to the main forest cover.

1 = temporarily unstocked area to polewood (DBH < 20 cm)
2 = minor tree stand (DBH 20 cm to < 35 cm)
3 = medium tree stand (DBH 35 cm to < 50 cm)
4 = strong tree stand (DBH 50 cm to < 70 cm)
5 = mature stand (DBH ≥ 70 cm)

5.7.2 Ground vegetation plant species of particular importance to forestry

If the following plant species occur in the sample circle with r = 10 m, the abundance of the ground vegetation is estimated as follows:

Plant species of importance to forestry

11 = bracken fern (*Pteridium aquilinum*)	
12 = stinging nettle (*Urtica dioica*)	
13 = sedges (*Carex brizoides*)	0 = not present
14 = creeping soft grass (*Holcus mollis*)	1 = sparse (up to 10%)
15 = reed grass (*Calamagrostis spec*.)	2 = rich (>10% to 50%)
16 = heather (*Calluna vulgaris*)	3 = extensive (> 50%)
17 = bilberry (*Vaccinium myrtillus*)	
18 = blackberry (*Rubus fruticosus agg*.)	
19 = giant hogweed (*Heracleum mantegazzianum*)	
20 = knotweed (*Fallopia japonica*, *F. sachalinensis*)	
21 = Himalayan balsam (*Impatiens glandulifera*)	
22 = small balsam (*Impatiens parviflora*)	
23 = American pokeweed (*Phytolacca americana*)	

Stand boundaries are not taken into consideration in these surveys.

5.7.3 Particularly protected forest biotopes

The following forest biotopes, particularly protected under federal or *Land* law (§ 30 of the Federal Nature Conservation Act[6], *Land* Nature Conservation Act, *Land* Forest Act), are identified:

0 = no special protection
1 = bog, swamp and lowland riparian forests (all *Länder*)

[6] Non-forest biotopes are only specified if they are covered by the Federal Nature Conservation Act. In this case, they are listed in groups in order to prevent too many rare categories. Federal Nature Conservation Act of 29 July 2009, Federal Law Gazette I, pp. 12542-2579 (entry into force on 1 March 2010)

2 = forests and shrubs in dry and warm locations (all *Länder*)
3 = ravine forests (all *Länder*)
4 = boulder and talus slope forests (all *Länder*)
5 = field copses (HE, MV, ST)
6 = regionally rare, semi-natural forest communities (BB, BW)
7 = slope forests (BB)
8 = structurally diverse forest edges (BW)
9 = old growth stands rich in tree cavities(SN)
10 = forests as relics of historical land management systems (BW)
11 = riparian woodlands (HE)
12 = pine-oak forests, oak-beech forests and oak-hornbeam forests (BE)
89 = subalpine larch and larch-arolla pine forests
91 = biotopes in humid and wet locations that are protected under § 30 of the Federal Nature Conservation Act and that may be forest according to the NFI definition (bogs, swamps, reed banks, wet meadows with abundant sedge and rushes, spring areas, inland salt sites, running or still fresh waters including their banks and the accompanying natural or semi-natural riparian vegetation as well as their natural or semi-natural sedimentation areas, dead water arms and regularly flooded areas)
92 = biotopes in dry locations that are protected under § 30 of the Federal Nature Conservation Act and that may be forest according to the NFI definition (open inland dunes, open natural boulder, talus and debris areas, clay and loess walls, dwarf shrub, broom and juniper heaths, matgrass communities, dry grassland meadows, heavy-metal plant communities)
93 = site formations that are protected under § 30 of the Federal Nature Conservation Act and that may be forest according to the NFI definition (cliffs and bold coasts, coastal dunes and barrier bars, Bodden with sedimentation areas)
94 = biotopes on the forest edge that are protected under § 30 of the Federal Nature Conservation Act and that may be forest according to the NFI definition (open rock formations, alpine grass as well as snow pockets and dwarf bushes in the Alpine area)

The categories 5 to 12 are only used in the *Länder* mentioned there.

The information refers to the plot.

5.7.4 Natural forest community

As a permanent attribute, the natural forest community must only be recorded during the first survey. In the case of new evidence, the information available from the previous surveys is corrected.

The natural forest community is the forest community of the present potential natural vegetation of a location. This is the model idea of the highest developed vegetation that may evolve under current site and flora conditions excluding any existing and future direct human impact on a site. The natural forest community also includes shade-intolerant tree species that occur for a limited time and space in pioneer phases of the natural forest development.

The natural forest community is taken from the preliminary detail data (Chapter 3.2.7) and corrected on-site, if necessary, in the event of the presence of an azonal natural forest community.
The information refers to the part of the forest cover that is included in the angle-count sampling 1(2) or the sample circle with r = 10 m. The natural forest community is also to be indicated for temporarily unstocked areas, but not for unstocked forest land.

5.7.5 Forest habitat type

The forest habitat types are surveyed according to the following list:

NFI code	N 2000-code	Designation of forest habitat types
0	0	Not a forest habitat type or not a forest habitat type to be dealt with in the scope of the NFI
2180	2180	Wooded dunes of the Atlantic coast
9110	9110	*Luzulo-Fagetum* beech forests
9130	9130	*Asperulo-Fagetum* beech forests
9140	9140	Subalpine beech woods with *Acer* and *Rumex arifolius* (only in high montane or subalpine altitude)
9150	9150	Calcereous beech forest of the *Cephalanthero-Fagion* (only on southerly, south-westerly or south-easterly slopes)
9160	9160	*Stellario-Carpinetum* oak-hornbeam forests

NFI code	N 2000-code	Designation of forest habitat types
9170	9170	*Galio-Carpinetum* oak-hornbeam forests
9180	*9180	*Tilio-Acerion* ravine forests
9190	9190	Old acidophilous oak woods with *Quercus robur* on sandy plains
9210	*91D0	Bog woodland (only used if none of the four subtypes can be classified)
9211	*91D1	Sphagnum birch woods
9212	*91D2	Scots pine bog woods
9213	*91D3	Mountain pine bog woods
9214	*91D4	Sphagnum spruce woods
9220	*91E0	Residual alluvial forests (*Alnion glutinoso-incanae*) (only in floodplains)
9230	91F0	Mixed oak-elm-ash forests of great rivers (only in floodplains)
9240	*91G0	Pannonic woods with *Quercus petraea* and *Carpinus betulus*
9410	9410	Acidophilous forests (*Vaccinio-Piceetea*)
9420	9420	Alpine *Larix decidua* and/or *Pinus cembra* forests

* priority habitat type

The information refers to the part of the forest cover that is included in the angle-count sampling 1(2) or the sample circle with r = 10 m.

The data collection program suggests the possible forest habitat types on the basis of the natural forest community, the tree species composition and other relevant data **(Annex 5)**. The team can deviate from this suggestion or change the natural forest community in justified cases.

In this context, the provisions on the tree species composition of the forest habitat types described in **Annex 6** are taken into account.

5.7.5.1 Wooded dunes (forest habitat type 2180)

The forest habitat type 2180 occurs only in the direct proximity of the coasts on coastal dunes, dune-covered barrier beach systems and on a small number of sandy intermediate zones, always in dune complexes

spatially linked to the actual beach. According to this definition, stands situated in isolation from the coast do not belong to forest habitat type 2180.

NFI code	0	1
Linked to the beach	No	Yes

5.7.5.2 Bog woodlands (forest habitat type 91Dx)

The following surveys are required to confirm forest habitat type 91Dx in the sample circle with r = 10 m

NFI code	0	1	2	3
Peat thickness	< 30 cm	≥ 30 cm		
Coverage peat mosses	< 5 %	≥ 5 % to 20 %	> 20 % to 30 %	> 30 %
Bog species	No individual	At least one individual		

*Bog species: *Calluna vulgaris* (common heather), *Empetrum nigrum* (black crowberry), *Erica tetralix* (cross-leaved heath), *Eriophorum spp.* (cottongrass), *Ledum pallustre* (wild rosemary), *Myrica gale* (bog myrtle), *Rhododendron ferrugineum* (rusty-leaved alpenrose), *Vaccinium myrtillus* (bilberry), *V. uliginosum* (bog bilberry), *V. vitis-idaea* (cranberry),

5.7.5.3 *Carpinetum* oak-hornbeam forests (forest habitat types 9160 and 9170)

The following surveys are required to designate the secondary forest habitat types 9160 and 9170 in the sample circle with r = 10 m:

NFI code	0	1
Carpinion type**	No individual	At least one individual

**Carpinion types: *Carpinus betulus* (hornbeam), *Dactylis polygama* (slender cock`s-foot), *Potentilla sterilis* (barren strawberry), *Ranunculus*

auricomus (Goldilocks buttercup), *Stellaria holostea* (greater stitchwort), *Vinca minor* (lesser periwinkle)

To distinguish between forest habitat type 9160 and 9170, it is recommended to either check the vegetation in the sample circle with r = 10 m for indicator species or carry out a site assessment.

1	9160 at least one individual present	*Alnus glutinosa*	Black alder
		Athyrium filix-femina	Lady fern
		Carex remota	Remote sedge
		Filipendula ulmaria	Meadowsweet
		Stellaria nemorum	Wood stitchwort
2	9170 at least one individual present	*Asarum europaeum*	European wild ginger
		Campanula persicifolia	Peach-leaved bellflower
		Carex pilulifera	Pill sedge
		Deschampsia flexuosa	Wavy hair-grass
		Hepatica nobilis	Anemone hepatica
		Lilium martagon	Martagon lily
		Teucrium scorodonia	Wood sage
		Viburnum lantana	Wayfaring tree
		Vincetoxicum hirundinaria	Swallow wort
11	9160 site	Documentation in the free text	
12	9170 site	Documentation in the free text	

The following additional indicator species are relevant in the *Länder* NI, HH and HB:

1	9160 at least one individual present (NI, HH, HB)	*Adoxa moschatellina*	Muskroot
		Allium ursinum	Wild garlic
		Anemone	Yellow anemone

		ranunculoides	
		Arum maculatum	Cuckoo pint
		Circaea spp.	Enchanter's nightshade
		Corydalis spp.	Corydalis species
		Gagea lutea	Yellow Star Of Bethlehem
		Impatiens noli-tangere	Touch-me-not balsam
		Leucojum vernum	Spring snowflake
		Primula elatior	True oxlip
		Ranunculus lanuginosus	Woolly buttercup
2	9170 at least one individual present (NI, HH, HB)	*Convallaria majalis*	Lily-of-the-valley
		Galium sylvaticum	Wood bedstraw

The following additional indicator species are relevant in NW:

1	9160 at least one individual present (NW)	*Allium ursinum*	Wild garlic
		Carex brizoides	Sedge
		Corydalis spp.	Corydalis species
		Festuca gigantea	Giant fescue
		Gagea lutea	Yellow Star Of Bethlehem
		Impatiens noli-tangere	Touch-me-not balsam
		Leucojum vernum	Spring snowflake
		Luzula luzuloides	Oakforest woodrush
		Luzula pilosa	Hairy woodrush
		Primula elatior	True oxlip
		Ranunculus lanuginosus	Woolly buttercup
2	9170 at least one individual present	*Convallaria majalis*	Lily-of-the-valley

	(NW)	*Galium sylvaticum*	Wood bedstraw

5.7.5.4 Acidophilous oak woods (forest habitat type 9190)

To confirm the secondary forest habitat type 9190 (natural forest community 1-7), verify in the sample circle with r = 10 m whether the following attributes are present:

Forest habitat type 9190 attribute	0	1
Sandy soils without solid bedrock at the surface and Periodically dry to periodically wet sites with moor grass (*Molina coerulea*) or Presence of an individual of *Calluna vulgaris* (common heather), *Calamagrostis sp.* (reed grass), *Deschampsia flexuosa* (wavy hair grass), *Dryopteris carthusiana* (spinulose wood fern), *Frangula alnus* (alder buckthorn), *Holcus mollis* (creeping soft grass), *Polypodium vulgare* (common polypody), *Pteridium aquilium* (bracken fern), *Trientalis europaea* (Arctic starflower), *Vaccinium myrtillus* (bilberry) or Secure basis (Chapter 3.2.10 No 1-3, 9 or Chapter 5.7.5.5 No 9)	No attribute present	At least one attribute present
Carpinion type	Not present	Present

5.7.5.5 Evidence of the designation of forest habitat types

8 = team decision
9 = separate visual inspection by experts
10 = taken from the preliminary detail data
11 = result of algorithm

5.7.5.6 Pressures and threats on the conservation status of forest habitat types

The following attributes are surveyed for plots with forest habitat type (Chapter 5.7.5) in the sample circle with r = 10 m:

	0	1	2
Degree of coverage of eutrophication indicators* only for naturally nutrient-poor forest habitat types 9110, 9190, 91D0	up to 10 %	> 10 to 50 %	>50 %
Degree of coverage of invasive woody plants** (uncontrolled occurrence of woody plants that are atypical for the habitat type)	0 %	> 0% to 10%	>10 %

* Eutrophication indicators: *Aegopodium podagraria* (ground elder), *Alliaria petiolata* (garlic mustard), *Elymus caninus* (bearded couch grass), *Gallium aparine* (cleavers), *Rumex obtusifolium* (broad-leaved dock), *Urtica dioica* (stinging nettle),

** Invasive woody plants: *Acer negundo* (box elder), *Ailanthus spp.* (tree of heaven), *Buddleja davidii* (summer lilac), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (red ash), *Mahonia aequifolium* (Oregon grape), *Prunus laurocerasus* (cherry laurel), *Prunus serotina* (black cherry), *Rhus spp.* (sumac), *Robinia pseudoacacia* (black locust), *Symphoricarpus spp.* (snowberry)

All occurring species are indicated.

The following attributes are surveyed for plots with forest habitat type (Chapter 5.7.5) in the sample circle with r = 25 m:

Driving tracks of vehicles (motor vehicles of all kinds and bicycles) off of regular pathways and forestry access tracks

0 = not recognisable
1 = recognisable

Recognisable driving tracks are, for example, visible ground compaction or damage or changes in herbaceous vegetation caused by vehicles (regardless of the time since driving occurred). Historic formation of hollows that obviously have not been used for a longer period are not considered an impairment.

Number of **forestry access tracks** in a sample circle with r = 25 m:

Code		Number of forestry acc. tracks					
0	=	none	6	=	3	14	= 7
1	=	½	7	=	3.5	15	= 7.5
2	=	1	8	=	4	16	= 8
3	=	1.5	9	=	4.5	17	= 8.5
4	=	2	10	=	5	18	= 9
5	=	2.5	11	=	5.5	19	= 9.5
			12	=	6	20	= 10
			13	=	6.5		

Forestry access tracks that are not located with their entire width in the sample circle are counted as ½ tracks.

5.8 Site attributes

5.8.1 Site form

As a permanent attribute, the site form must only be surveyed during the first survey.

The predominant site form at the sampling point is recorded.

0 = level site
1 = hilly / undulating
2 = valley site
21 = valley site without cold-air pooling
22 = valley site with cold-air pooling
3 = hillside
31 = on the lower part of the hillside
32 = in the middle of the hillside
33 = on the upper part of the hillside
4 = high altitude site, ridge site, high plateau site

The use of the two-digit codes is optional and is determined uniformly for each *Land*.

The following codes are used in the *Länder*:

SH, HE, RP, SL, BE, BB, MV, TH 0 / 1 / 2 / 3 / 4
HH, NI, HB, NW, BW 0 / 1 / 2 / 31 / 32 / 33 / 4
BY, SN, ST 0 / 1 / 21 / 22 / 31 / 32 / 33 / 4

5.8.2 Site gradient

As a permanent attribute, the site gradient must only be surveyed during the first survey.

The gradient of the site is measured with the range finder within a radius of 25 m in the direction of the main incline and indicated in degrees.

A conversion from percentages to degrees can be made using the table in **Annex 10**.

5.8.3 Site aspect

As a permanent attribute, the site aspect must only be surveyed during the first survey.

The aspect of the site (direction of incline) is measured within a radius of 25 m with the compass (graduation: 400 gon) viewing in the direction of the main incline.

On level sites (up to 3 degree slope), the site aspect does not have to be measured.

5.9 Deadwood

5.9.1 Selection

The occurrence of deadwood is recorded in a sample circle with a radius of 5 m. Pieces of deadwood lying on the ground are assigned entirely to the sample if the thick (=root) end lies within the sample circle. In this context, every lateral branch that is connected to such a piece of deadwood and has a diameter of at least 10 cm is recorded separately.

Recently felled timber or timber made ready for hauling, processed timber (raised hides, benches, fencing posts) as well as stumps that can sprout again in the coppice forest are not recorded. Trees that probably

died less than 12 months ago are not counted as deadwood either. Forgotten, unhauled timber, on the other hand, is considered deadwood. Deadwood on living trees is not indicated.

The survey includes all deadwood with a diameter ≥ 10 cm at the thicker end and root stocks with a diameter at felling height ≥ 20 cm. With regard to lying fragments without root collar, this threshold refers to the diameter at the thicker end, whereas with regard to the other types of deadwood, it refers to the diameter to be measured in accordance with Chapter 5.9.4.

In the case of piles of unhauled timber, all pieces are considered that reach into the sample circle; the conditions regarding minimum diameter and location of the thick end do not apply in this respect.

Deadwood is also recorded on temporarily unstocked areas, but not on unstocked forest land.

Pieces of deadwood lying on the ground with their thick (=root) end outside the sample circle are not recorded – even if a part of the piece lies inside the sample circle.

5.9.2 Deadwood tree species group

1 = coniferous trees
2 = deciduous trees (except oak)
3 = oak

5.9.3 Type of deadwood

11 = lying, whole tree with root collar
12 = lying, trunk fragment with root collar
13 = lying, fragment without root collar
2 = standing, whole tree
3 = standing, fragment (height ≥ 1.3 m)
4 = root stock, (height < 1.3 m)
5 = unhauled timber (piled up)

5.9.4 Diameter of deadwood

The following diameters are indicated in cm. The measurement is made as found, with or without bark (without bark in the case of stumps).

Standing deadwood	Diameter at breast height
Lying trees or trunk fragments (from 130 cm in length) with root collar	Diameter at breast height
Lying fragments without root collar and lying trunk fragments < 130 cm in length with root collar	Diameter at both ends
Stumps	Diameter at felling height In the case of stumps, the largest occurring diameter at felling height (including root collars) without bark is measured.
Unhauled timber	Average mid-diameter

Measurement aids can be used (e.g. callipers, putting the girth measuring tape around the half of the girth and doubling this value).

5.9.5 Length of deadwood

The height of standing deadwood and stumps and the length of lying deadwood are measured in dm. In the case of lying trees or trunk fragments with root collar, the lower measuring point is where the earth's surface used to be.

In the case of hollow root stocks, the height is rounded down or reduced in such a way that the hollow is filled by the timber volume above this height.

Several separate sections of an originally longer piece of deadwood can be measured as one piece. This measurement aid has no impact on the selection of the deadwood according to Chapter 5.9.1.

5.9.6 Degree of decomposition of deadwood

Description of the categories regarding the degree of composition of deadwood:

1 =	undecomposed	bark still on the trunk
2 =	beginning decomposition	bark loosening to missing, wood can still be cut with an axe, in the case of heart rot < 1/3 of the diameter
3 =	advanced decomposition	sapwood soft, heart can only partly be cut with an axe, in the case of heart rot > 1/3 of the diameter
4 =	heavily decomposed	wood soft all the way through, crumbly if trodden on, contours disintegrated

Deadwood is also to be surveyed if it is hidden under moss.

5.10 Forest edges and stand boundaries

Information available from a previous survey is verified and, if necessary, corrected. New forest edges and stand boundaries (boundaries) are surveyed in addition.

5.10.1 Locating forest edges and stand boundaries

Boundaries are located if the marginal circle of a sample tree of the angle-count sampling with basal area basal area factor 4 (Chapter 5.5.1) is intersected. These are all stand boundaries within a radius of 25 times the diameter at breast height around sample trees of the angle-count sampling. Stand boundaries at a distance of over 25 m from the plot are not located, however.

The boundaries located during the previous inventory are verified. If the data are correct, the boundaries do not have to be located again.

Locating the boundaries is simplest if horizontal distance and azimuth are determined for two points on the boundary line. If the boundary line does not run straight, a further point is located at the point of breakage. The survey locating points on the boundary should be at least 10 m apart. For one plot, a maximum of two boundaries can be recorded.

Two separately located boundary lines must neither cross nor touch one another between the located starting and end points.

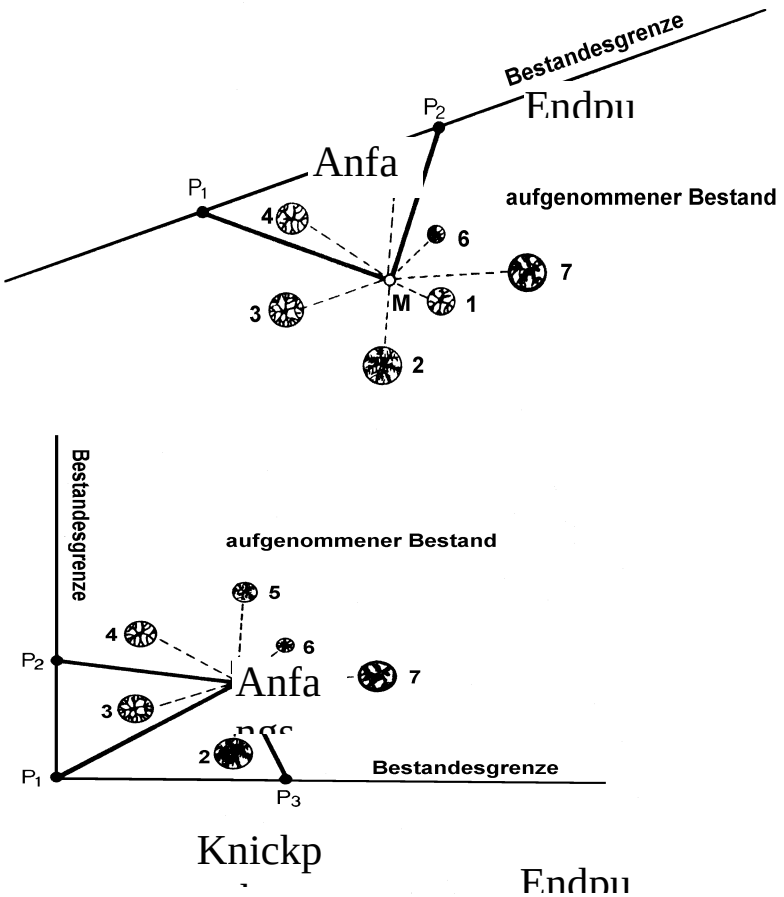


Figure 7: Locating forest edges and stand boundaries

If the actual situation cannot be described correctly with two lines, the two boundaries that are closest to a sample tree of the angle-count sampling (basal area factor 4) are recorded.

If a boundary line has more than one point of breakage within the area to be located, the course is to be straightened so that the deviation from the actual situation is as small as possible.

The boundary line normally runs along the outer crown area (edge). If the adjoining form of land use is clearly demarcated (e.g. fence, road), this demarcation forms the boundary line. In the case of tracks less than 5 m wide (timberland belonging to the forest), the centre line of the track is located as the boundary line.

The located boundaries are also shown in the cluster sketch for the angle-count sampling on the data-entry terminal (MDE). The data are checked by the team on site, comparing the sketch with the actual situation.

The direction is always determined from the plot to the measuring point on the boundary line.

A code number for the boundary (Chapter 5.10.2) is entered to indicate the validity of boundaries.

5.10.2 Selection and locating

All forest edges within a radius of 25 m around the plots in the forest are described. The locating takes place as described in Chapter 5.10.1.

A forest edge is also recorded if unstocked forest land (which, according to the definition of forest, is also part of the forest) adjoins the forest stand or if the plot is situated on temporarily unstocked land.

If the temporarily unstocked area borders on a non-forest, the forest edge is described as forest edge type 1 or 2, depending on whether, and if so at what distance, more forest is located behind the non-forest.

The border between a temporarily unstocked area and a tree stand is not considered a forest edge but a stand boundary (forest edge type 4 or 3). This stand boundary does, however, not have to be located.

Code number for the boundary

0 = new boundary
1 = boundary taken from a previous survey
4 = newly located boundary that is also valid for previous surveys
9 = boundary of a previous survey that can no longer be found or that is no longer valid

5.10.3 Type of forest edge or stand boundary

1 = outer edge of forest – at least 50 m distance to the boundary line of the opposite forest edge
2 = inner edge of forest - between 30 m and 50 m distance to the boundary line of the opposite forest edge
3 = stand boundary between stands directly bordering on one another (< 30 m distance) with the adjoining stand at least 20 m lower in height (this can also be a temporarily unstocked area or unstocked forest land)
4 = other located stand boundary

5.10.4 Adjoining terrain

The adjoining terrain is indicated for all boundaries.

0 = stocked timberland
1 = built-up areas (residential, traffic, commercial areas)
2 = arable land
3 = meadows and pastures
4 = forest succession (not forest according to the definition in Chapter 5.2)
5 = wetland
6 = water body
7 = upland moor
8 = rocky areas
9 = timber-line in the mountains
10 = other extensively used or unused land
11 = unstocked forest land
12 = temporarily unstocked area
13 = other stand with survey
14 = other stand without survey (inaccessible)

The decisive factor is the area that directly adjoins the boundary within the sample circle with r = 25 m. However, tracks or roads up to 5 m wide running directly along the boundary are not to be taken into account if another category lies beyond them.

If the adjoining terrain within the sample circle with r = 25 m changes, the category with the greatest length within the sample circle is indicated.

Annex 1: Contact persons for the coordination of the National Forest Inventory at federal level

Tasks	Name	Postal address	Telephone	E-Mail
Coordination	Friedrich Schmitz	BMELV, Div. 535, P.O. Box 14 02 70 53107 Bonn	0228/ 99529 4167	Friedrich.Schmitz@BMELV.Bund.de
Federal inventory administration	Dr. Heino Polley	vTI, Institut für Waldökologie und Waldinventuren Alfred-Möller-Str. 1 16225 Eberswalde	03334/ 65 306	heino.polley@vti.bund.de
Data management, software	Petra Hennig		03334/ 65 319	petra.hennig@vti.bund.de
NFI 2012 helpline			03334/ 65 309	bwi3de-support@vti.bund.de
Forest habitat types	Dr. Eckhard Schröder	Bundesamt für Naturschutz, Konstantinstr. 110, 53179 Bonn	0228 / 8491 - 1540	Eckhard.Schroeder@BfN.de

Annex 2: Addresses of the *Land* inventory administrations (as of 13 August 2010)

Land	Authority / Staff member	Address	Telephone	E-Mail
BW	FVA Freiburg, Dr. Kändler, Gerald	Wonnhaldestr. 4 79100 Freiburg	0761/ 4018-120	Gerald.Kaendler@forst.bwl.de
BY	LWF Freising, Dr. Klemmt, Hans-Joachim	Hans-Carl-von-Carlowitz-Platz 1 85354 Freising	08161/ 71-5152	Hans-Joachim.Klemmt@lwf.bayern.de
BE	see BB			
BB	Landesbetrieb Forst Brandenburg - BT LFE - Müller, Jörg	Seeburger Chaussee 2, Haus 4 14479 Potsdam	033 201-445240	Joerg.Mueller@lfe-p.brandenburg.de
HB	see NI			
HH	see NI			
HE	HESSEN - FORST FENA - Forsteinrichtung und Naturschutz Ullrich, Thomas	Europastrasse 10-12 35394 Giessen	0641-4991-307	Thomas.Ullrich@forst.hessen.de
MV	Landesforst M-V, AöR Lindenkreuz, Katja	Fritz Reuter Platz 9 17139 Malchin	03994/235-125	katja.lindenkreuz@lfoa-mv.de

Land	Authority / Staff member	Address	Telephone	E-Mail
NI	Niedersächsische Landesforsten / Nds. Forst-planungsamt FOR Neupert, Uwe	Forstweg 1a 38302 Wolfenbüttel Postanschrift: intern bR	05331/ 3003-0 Mobile 0171/ 978 178 1	Uwe.Neupert@NFP.Niedersachsen.De
NW	Landesbetrieb Wald und Holz NRW Falkenried, Lutz	Brößweg 40 45897 Gelsenkirchen	(02931) 7866179	lutz.falkenried@wald-und-holz.nrw.de
RP	Zentralstelle der Forstverwaltung, Diesler, Joachim	Südallee 15-19 56068 Koblenz	0261 /120 26 54	Joachim.Diesler@wald-rlp.de
SL	Saarforst-Landesbetrieb, Fritz, Erich	Von der Heydt 12 66115 Saarbrücken	0681/ 9712-116	e.fritz@sfl.saarland.de
SN	Staatsbetrieb Sachsenforst Geschäftsleitung Referat 44 FOR Schmid, Michael	Bonnewitzer Str. 34 01796 Pirna	03501-46189-13	Michael.Schmid@smul.sachsen.de
ST	Landeszentrum Wald Binnemann, Ernst	Haferfeld 06507 Gernrode	039485/971 64	e.binnemann@lzw.mlu.sachsen-anhalt.de
SH	MLUR SH Hinrichsen, Rolf-Peter	Mercatorstr. 3 24106 Kiel	0431/988-7076	Rolf-Peter.Hinrichsen@mlur.landsh.de

Land	Authority / Staff member	Address	Telephone	E-Mail
TH	TLWJF Gotha Schwerhoff, Jürgen	Jägerstr. 1 99867 Gotha	03621/225 168	juergen.schwerhoff@forst.thueringen.de

Annex 3: Services of the Institute for Federal Real Estate – federal forest operations (as of 25 October 2010)

No	Main name	Street	Town	Telephone	Fax	E-mail
1	Trave	Herrenschlag 10a	23879 Mölln	04542 / 85670-0	04542 / 85670-20	BF-Tra@Bundesimmobilien.De
2	Vorpommern-Strelitz	Liepgartener Str. 50	17373 Ueckermünde	039771 / 235-07	039771 / 235-10	BF-VoS@Bundesimmobilien.De
3	Niedersachsen	Forstweg 2	29683 Fallingbostel-Wense	05163 / 98868-0	05163 / 98868-22	BF-Nds@Bundesimmobilien.De
4	Lüneburger Heide	Philosophenweg 70	29303 Lohheide	05051 / 9884-0	05051 / 9884-40	BF-LHe@Bundesimmobilien.De
5	Nördliches Sachsen-Anhalt	Steinberge 2	39517 Dolle	039364 / 930-0	039364 / 930-50	BF-nSA@Bundesimmobilien.De
6	Mittelelbe	Kurhutweg 1	04849 Durchwehna	034243 / 2869-0	034243 / 2869-29	BF-mEl@Bundesimmobilien.De
7	Westbrandenburg	Berliner Str. 98-101	14467 Potsdam	0331 / 3702-272	0331 / 3702-271	BF-WeB@Bundesimmobilien.De
8	Havel-Oder-Spree	Wasserburger Str. 5	15748 Klein Wasserburg	033765 / 208-31	033765 / 208-37	BF-HOS@Bundesimmobilien.De
9	Rhein-Weser	Lindberghweg 80	48155 Münster	0251 / 6749-0	0251 / 6749-20	BF-RhW@Bundesimmobilien.De
10	Thüringen-Erzgebirge	Am See 25	36433 Bad Salzungen	03695 / 6063-75	03695 / 6280-85	BF-ThE@Bundesimmobilien.De
11	Lausitz	Kaupener Str. 7a	02957 Weißkeißel	03576 / 2531-0	03576 / 2531-10	BF-La@Bundesimmobilien.De
12	Rhein-Mosel	Grünbacher Weg 7	55774 Baumholder	06783 / 99998-10	06783 / 99998-17	BF-RhM@Bundesimmobilien.De
13	Schwarzenborn	Küppelstr. 6	36280 Oberaula	06628 / 915290	06628 / 8529	BF-Sb@Bundesimmobilien.De
14	Reußenberg	Rommelstr. 2	97762 Hammelburg	09732 / 78313-0	09732 / 78313-29	BF-Rb@Bundesimmobilien.De
15	Grafenwöhr	Kellerweg 3	92249 Vilseck	09662 / 4101-0	09662 / 4101-23	BF-Gw@Bundesimmobilien.De
16	Hohenfels	Kreuzbergstr. 14	92287 Schmidmühlen	09474 / 9517-0	09474 / 9517-30	BF-Hf@Bundesimmobilien.De
17	Heuberg	Haupstraße 56 und 58/1	72469 Meßstetten	07431/ 94933-0	07431 / 94933-25	BF-Hb@Bundesimmobilien.De

Annex 4: List of natural forest communities

No	English description	Botanical name	Forest communities included according to Oberdorfer (1992)
1	Luzulo-Fagetum beech forests, sometimes with firs	*Luzulo-Fagetum*	*Ilici-Fagetum, Polygonato verticilatae-Fagetum*
2	Wavy hair grass-beech forest	*Deschampsio-Fagetum*	
3	Woodruff-beech forest, sometimes with firs	*Galio-Fagetum*	*Dentario enneaphylli-Fagetum, Dentario heptaphylli-Fagetum*
4	Wild rye-beech forest, sometimes with firs	*Hordelymo-Fagetum*	
5	Beech-durmast oak forest, including the wet variant of the beech-common oak forest	*Fago-Quercetum*	*Holco-Quercetum*
6	Alpine honeysuckle-fir-beech forest	*Lonicero-Fagetum*	*Cardamino-Fagetum, (syn. Aposerido-Fagetum)*
7	Sedge-beech forest	*Carici-Fagetum*	*Seslerio-Fagetum*
8	Spruce-beech forest	*Fago-Piceetum*	*Calamagrostio villosae-Fagetum*
9	Sycamore maple-beech forest	*Aceri-Fagetum*	
10	Wood rush-spruce-fir forest	*Luzulo-Abietetum*	
11	Bedstraw-spruce-fir forest	*Galio-Abietetum*	

No	English description	Botanical name	Forest communities included according to Oberdorfer (1992)
12	Cranberry-spruce-fir forest	*Vaccinio-Abietetum*	
13	Wintergreen-spruce-fir forest	*Pyrolo-Abietetum*	
14	Birch-common oak forest	*Betulo-Quercetum*	*Genisto-Quercetum*
15	Birch-durmast oak forest	*Luzulo-Quercetum*	
16	Cranberry-oak forest and Leucobryum moss-pine forest	*Vaccinio-Quercetum und Leucobryo-Pinetum*	
161	Cranberry-oak forest	*Vaccinio-Quercetum*	
162	Leucobryum moss-pine forest	*Leucobryo-Pinetum*	
17	Stitchwort-hornbeam-common oak forest	*Stellario-Carpinetum*	
18	Wood bedstraw-hornbeam-durmast oak forest	*Galio-Carpinetum*	
19	Durmast oak-lime forests		
20	Xerothermic oak-mixed forests	*Quercion pubescentis, Carpinion p.p.*	*Aceri monspes-sulani-Quercetum, Quercetum pubes-centi-petraeae, Cytiso-Quercetum, Potentillo-Quercetum, Genista-Quercus community, Carici-Tilietum*

No	English description	Botanical name	Forest communities included according to Oberdorfer (1992)
21	Winter heath-pine forests	*Erico-Pinion*	*Erico-Pinetum, Cytiso-Pinetum, Coronillo-Pinetum, Calamagrostio-Pinetum*
22	Steppe pine forest	*Pyrolo-Pinetum*	
23	Maple-ash forest	*Adoxo-Aceretum*	
24	Talus and scree valuable broadleaved forests	*Lunario-Acerenion p.p., Tilienion platyphylli, Deschampsio-Acerenion*	*Fraxino-Aceretum, Sorbo-Aceretum, Ulmo-Aceretum, Querco-Tilietum, Deschampsia-Acer community, Aceri-Tilietum*
25	Green alder grove	*Alnetum viridis*	
26	Carpathian birch-rowan-boulder forest	*Betula-Sorbus* community	
27	Boulder spruce forest	*Asplenio-Piceetum*	
28	Bazzania moss-spruce forest	*Bazzanio-Piceetum*	
29	Small reed-spruce forest	*Calamagrostio-Piceetum*	
30	Alpine coltsfoot // lettuce-spruce forest	*Homogyno-Piceetum*	
31	Alpenrose-dwarf pine groves	*Erico-Pinion p.p., Rhododendro-Vaccinienion p.p.*	*Erico-Rhododendretum hirsuti, Vaccinio-Rhododendretum*
32	Larch-Swiss stone pine forest	*Vaccinio-Pinetum cembrae*	

No	English description	Botanical name	Forest communities included according to Oberdorfer (1992)
33	Bog bilberry-moorland forests	*Piceo-Vaccinienion*	*Vaccinio uliginosi-Piceetum, Vaccinio uliginosi-Pinetum sylvestris, Vaccinio uliginosi-Pinetum rotundatae, Vaccinio uliginosi-Betuletum*
34	Black alder alluvial forests	*Alnion glutinosae*	*Carici elongatae-Alnetum, Sphagno-Alnetum, Caltha-Alnus* community
35	Bird cherry-alder-ash alluvial forests	*Pruno-Fraxinetum*	*Ribeso-Fraxinetum*
36	Ash brook forests	*Carici remotae-Fraxinetum*	*Equiseto-Fraxinetum, Carex remota-Alnus incana* community
37	Ash-alder forest of fast flowing rivers	*Stellario-Alnetum*	
38	Grey alder riparian forest	*Alnetum incanae*	
39	Oak-elm floodplain forest	*Querco-Ulmetum*	
40	Lowland alluvial willow forest	*Salicetum albae*	

Annex 5: Assignment of natural forest communities to forest habitat types

Natural forest community (cf Annex 4)	Forest habitat type (cf page 61)														
	2180	9110	9130	9140	9150	9160	9170	9180	9190	91D0	91E0	91F0	91G0	9410	9420
1	1	1				~~2~~	~~2~~		2						
2	1	1				~~2~~	~~2~~		2						
3	1		1			~~2~~	2								
4	1		1			2	2								
5	1	1				2	2		3						
6			1			2	2								
7					1		2								
8		~~(~~1~~)~~												~~1~~	
9				1											
10				~~1~~										1	
11			1	~~1~~											
12				~~1~~										1	
13			1	~~1~~											
14	1								1						
15	1								1						
161	1								1						
162	1														
17						1									
18							1								
19								1					(1)		
20															
21															
22															
23								1							
24								1							
25															
26								1							
27														1	
28														1	
29														1	
30														1	
31															
32															1
33										1					
34															
35											1				
36											1				
37											1				
38											1				
39						(2)	(2)					1			
40											1				

1 = primary forest habitat type
2 = secondary forest habitat type
3 = both primary and secondary forest habitat type
() = does not take the NFI algorithm into account

Annex 6: Identifying a forest habitat type according to tree species composition

	Forest habitat type if	Conjunction	Restrictions
1.	M ≥ 30	AND	
2.	M + S ≥ 50	AND	
3.	M + S + P ≥ 70	AND	
4.	Sum of coniferous trees max. 50 %	AND	in deciduous-dominated forest habitat types (all except 94XX, 91Dx except 91D1)
5.	P + S + M ≥ 70 and M ≥ 10 %	OR	only in forest development phase 1
6.	≥ 30 cm peat thickness	AND	only in 91Dx
7.	≥ 5 % coverage peat mosses	AND	only in 91Dx
8.	≥ one species from the list bog species[1]	AND	only in 91Dx
9.	Occurrence of oak-hornbeam species in 10 m circle [2]	AND	in secondary 9160 and 9170
10.	< 10 % beech	AND	in 9160 or in part of area not dominated by Atlantic climate of 9190[3] (only at secondary locations, nat. forest communities 1-6)
11.	< 30 % beech	AND	in 9170 or in part of area dominated by Atlantic climate of 9190[3] (only at secondary locations, nat. forest communities 1-7, 39)
12.	If beech < 30 % and ≥ oak, then beech forest habitat type	AND	in 9170 or in part of area dominated by Atlantic climate of 9190[3] and in development phase 1 (only at secondary locations, nat. forest communities 1-7, 39)
13.	If beech < 30 % and < oak, then 9170 or 9190	AND	in 9170 or in part of area dominated by Atlantic climate of 9190[3] and in development phase 1 (only at secondary locations, nat. forest communities 1-7, 39)
14.	Proximity to sea and only on coastal dunes	AND	2180 only
15.	Classification in cases of doubt		In case of doubt between 9180 and 91G0: 9180 9170 and 91F0: 9170 9110 and 9410: 9410

M = main tree species, S = secondary tree species, P = pioneer tree species

[1] Dwarf shrubs: *Vaccinium myrtillus, V. uliginosum, V. vitis-idaea, Calluna vulgaris, Empetrum nigrum, Myrica gale, Erica tetralix, Rhododendron ferrugineum),* cotton grasses *(Eriophorum spp.), Ledum palustre*

[2] *Carpinion* species: *Carpinus betulus, Dactylis polygama, Ranunculus auricomus, Stellaria holostea, Potentilla sterilis, Vinca minor,*

[3] The Atlantic region encompasses the *Länder* of Bremen (HB), Hamburg (HH), Lower Saxony (NI), Mecklenburg-Western Pomerania (MV), Schleswig-Holstein (SH)

Annex 7: Distinguishing characteristics between common oak (110) and sessile oak (111)

Brief guide

Typical character-istic	Common oak (110) *Quercus robur*	Sessile oak (111) *Quercus petrea*	Comments
Sinus veins	**Almost always** sinus veins in the middle third of the leaf	**No** sinus veins in the middle third of the leaf	Sinus veins are axillary veins of the first order that do not lead to lobes but to sinuses at the edge of the leaf. Sinus veins that are longer than half the distance between the origin of the vein and the leaf sinus of destination are relevant.
Petioles	**Short** → 2 to 10 mm	**Long** → 12 to 25 mm	The length of the petiole is measured from the base of the stalk to the lower attachment of the leaf blade.
Peduncles	**Long** → 10 to 60 mm	**Short** 1 to 20 mm	The length of the peduncle is measured to the attachment of the cupula of the first fruit. If the first fruit has already fallen prematurely, the stigma of the point of adhesion serves as measuring point.
Leaf base	Strongly **cordate**, auriculate	Narrow-cuneate	
Pubescence	**No** pubescence on the underside of the leaf	**Abundant** pubescence in the angles of the veins on the underside of the leaf	Pubescence is made up of bushy trichomes on the epidermis and contiguous to the pedate. If pubescence exists, it is always to be found on the underside of the leaf.

Detailed guide

Distinguishing characteristics		Common oak (110) *Quercus robur*	Sessile oak (111) *Quercus petrea*
1.	**Habit** Entire tree	Trunk more massive, more twisted. Tendency for trunk to disintegrate with deep attachment of massive, irregular "more gnarled" branches extending apart from one another as far as horizontally, crown as a result arched widely and flatter. Trunk and branches more often contorted, more frequently than sessile oak; more numerous stronger roses.	Trunk usually straight, crown stem, branches set higher, branching off radially at acute angles so that the ideal type of crown appears an elongated oval and highly arched.
1.1	**Form of trunk and crown** (from about 80-100 years and older)		
1.2	Foliage	Leaves on short shoots and twigs amassed in clusters; crown as a result irregular, but against the sky thicker, darker and more opaque.	On account of the long petiole of the leaves and their more even distribution, more loosely woven and transparent crown ("aspen effect").
1.3	**Bark** (on older trees)	Coarsely, thickly and deeply ridged, hard, outside light grey, inside reddish; short, narrow vertical plates with transverse cracks. The coarse bark extends higher on the trunk and the main branches than in the case of the sessile oak; coarser or finer bark on about half a trunk each is less distinctive than in the case of the sessile oak.	Bark finer, furrows and ribs running through longer distances, lesser strength, rather soft (easy to make an impression), inside yellowish; sessile oak bark on older trees is almost always finer on one side of the trunk and coarser on the other (similar to common oak) without this having anything to do with the "weather side".
1.4	Timber	Dark, harder; annual rings irregular and often wider especially when the tree is young.	More regular, lighter; annual rings narrower and also more regular.

Distinguishing characteristics		Common oak (110) *Quercus robur*	Sessile oak (111) *Quercus petrea*
2.	Leaves	Petiole max. 1 cm, leaf base distinctly auriculate (but usually irregular); leaf less long and in the centre of the leaf to the upper third of the leaf broader in relation to the length than in the case of the sessile oak. Wide variety of leaf forms. Fewer (4-5) larger and often coarser, irregular lobes;	Petiole clear, 1-2 cm, leaf base cuneate or light, cordate indication of lobes; leaf form tends to be more elongated and narrower, largely laterally symmetrical with numerous more evenly rounded pairs of lobes;
		Fewer axillary veins than sessile oak, principal veins do end in the lobes, but frequently lateral veins which end in the sinuses;	Axillary veins on account of the multiple lobes in larger number and exclusively ending in the lobes;
		Primary shoots of different colour tones: yellow-copper-brown-reddish; later upper surface matte green, more rarely slightly shiny, underneath light bluish-green and always hairless; lammas shoots as a rule distinctly reddish.	Primary shoots on opening yellowish green; later upper surface shiny green, underneath matte green with pubescence in the sinus angles (magnifying glass!) and individual hairs on the veins.
2.1	Appear-ance and autumn colouration	Leaf edges especially towards autumn become undulating, after falling also rolled up and concealed; variegated green-yellow-beige-light orange, underneath lighter	Late summer and autumn leaves thick, leathery and coarse, flatter; first uniformly yellow, then upper surface shiny (deep) brown, underneath lead grey
		Changes colour later (summer oak) at same location. Sheds leaves in autumn.	Changes colour earlier (winter oak) at same location. Whithered leaves usually remain on the tree until spring.
3.	Shoots		
3.1	Buds	Strikingly clustered at end of shoot, more thick-ovoid, tapering to blunt end, highly squamous	Distributed more individually and regularly along the entire twig, more slender-ovoid to pointed
3.2	Shooting	Earlier, early to mid-May, but depending on location and aspect	Later, mid to late May, but depending on location and aspect

Distinguishing characteristics		Common oak (110) *Quercus robur*	Sessile oak (111) *Quercus petrea*
3.3	Young shoots	Greenish brown, only slightly pruinose, brownish lenticels	Dark grey, in part reddened and grey pruinose
4.	Blossom (female)	Terminal, 1-2 peduncles 2-5 cm long, usually with 2-5 (or more) flowers on peduncle, spherical brown-red	Terminal, sessile or on very short peduncles. 2-6 flowers whitish, spherical.
5.	Fruits (acorns)	On peduncles 4-13 cm long, each with 1-5 lateral acorns, mostly longer and elliptical; largest ∅ in the middle or top half;	Directly sessile on the tip of the shoot or with 0.5-1.5 cm long peduncle, individual or in clusters of 2-6; in diameter smaller and squatter than those of the common oak; ovoid, with largest ∅ almost always in the bottom third;
		Loamy brown with dark lengthwise stripes when fresh;	Well ripened, coffee brown without lengthwise stripes; on drying out variegated;
		Do not germinate in autumn or only to limited extent and therefore winter better.	Often germinate strongly in the autumn, often already on the trees.
6.	Seedlings and young plants	Always grow from a side bud at the tip, therefore twisted.	2 year-old plants and older usually grow from terminal bud.

Annex 8: Distinguishing characteristics between European white birch (NFI code 200), *Betula pubescens ssp. pubescens* and *Betula pubescens ssp. carpatica*) (NFI code 201)

Characteristics in descending order of importance, crucial characteristics underlined

Typical characteristic	European white birch (common birch) *Betula pendula* Code 200	Downy birch *Betula pubescens ssp. pubescens*	Carpathian birch *Betula pubescens ssp. carpatica*	Comments
		NFI Code 201		
Pubescence of leaves and twigs	Leaves and young twigs hairless, young twigs sticky-warty/glandular	Leaves and young twigs clearly hairy, twigs slowly becoming glabrous, leaves pubescent at least underneath + persistently	Leaves and young twigs only slightly pubescent and quickly becoming glabrous	Magnifying glass!
Leaf shape	Triangular-rhombic shape, long apiculate, 2.5-6 cm long and 2-4 cm wide; margin biserrate	Ovoid, 3-8 cm long and 2-6 cm wide, short apiculate, widest under the centre of the leaf, margin biserrate to irregularly serrate	Rhombic-rounded shape, short apiculate, 2.5-5 cm long, 2-4 cm wide, widest in the centre; margin biserrate	Assessment only for normally developed plants, not for water sprouts, shade plants, etc.
Fruits	Samara wings 2-3x wider than seed	Samara wings ± wide as the seed		Magnifying glass!
Habit	Branches often hanging	Branches ± upright or spreading		Characteristic not applicable to young growth
Bark	White, fissured towards the base	Yellowish-white, ± remaining smooth	Yellowish-reddish or brown, ± remaining smooth	Characteristic not applicable to young growth

Typical characteristic	European white birch (common birch) *Betula pendula* Code 200	Downy birch *Betula pubescens ssp. pubescens*	Carpathian birch *Betula pubescens ssp. carpatica*	Comments
		NFI Code 201		
Habitat	Wide amplitude, on moist to dry and often base- and nutrient-poor soils	Wide amplitude, mostly on clearly moist to wet soils	Slightly dryer locations than ssp. pubescens, at bog edges and on boulder fields	Can only be used as additional information, to be verified in any case against morphological characteristics

Annex 9: Distinguishing characteristics for poplar

Taxon of the genus Populus	European black poplar (*Populus nigra*)	Balsam poplar and hybrids (*P. balsamifera*, here also *P. x canadensis*, etc.)	Silver-leaf poplar, white poplar (*P. alba*)	Grey poplar (*P. x canescens*)	Aspen (*P. tremula*)
NFI Code	221	224	223	222	220
Leaf shape, leaf margin and petiole	Regularly toothed, margins more or less unciliate, rhombic-triangular shape, apex often more pointed; petioles laterally compressed	Leaf blade truncate to cordated, margins often initially with long cilia or often glabrous, petioles round or laterally compressed	On long shoots clearly 3 to 5-lobed, on short shoots ovoid-rounded	On long shoots sparsely lobed, on short shoots rounded	Margins without or with only very thin transparent edge (magnifying glass!); irregularly sinuate-toothed, rounded to wide ovoid, petiole clearly longer than leaf blade
Pubescence of leaves	Underneath glabrous or slightly pubescent	Underneath glabrous or slightly pubescent	Underneath persistently felted white	Felted white or grey when young, quickly becoming glabrous	Underneath glabrous or slightly pubescent

Taxon of the genus Populus	European black poplar (*Populus nigra*)	Balsam poplar and hybrids (*P. balsamifera*, here also *P. x canadensis*, etc.)	Silver-leaf poplar, white poplar (*P. alba*)	Grey poplar (*P. x canescens*)	Aspen (*P. tremula*)
Glands on petiole near base of leaf blade	None	Variable	None	0-4	Approx. 2
Buds	Glabrous, very sticky, brownish-red	Glabrous, very sticky, brownish-red	Felted white, not sticky	Felted, not sticky	Glabrous, getting slightly sticky not before spring
Young twigs	Round, red or green, glabrous	Round-squared, partly corky-barked, glabrous to rarely slighty pubescent	Green, felted white	Green-reddish, felted white to slightly pubescent	Glabrous, cylindrical, shiny, yellow-brown-reddish
Bark	On the upper part white-grey, on the lower part net-like patterns, furrowed, sometimes with corky ridges	Variable, often heavily fissured	White-grey	Yellow-grey with horizontal lenticel bands	Yellow-brown, smooth, often cross-zonal

Taxon of the genus Populus	European black poplar (*Populus nigra*)	Balsam poplar and hybrids (*P. balsamifera*, here also *P. x canadensis*, etc.)	Silver-leaf poplar, white poplar (*P. alba*)	Grey poplar (*P. x canescens*)	Aspen (*P. tremula*)
Comments	A poplar that meets all characteristics underlined above very likely belongs to *P. nigra*; a definite differentiation between 221 and 224 is difficult and only possible with special keys[1] or genetic typing	Code 224 covers all other tall poplars, the group characteristics are therefore less clear;*P. x canadensis* is probably most common (extensive); differentiation only possible with special keys	Species is easily identifiable in the field	Bastard between 223 and 220	Species is easily identifiable in the field

[1] Koltzenburg, Michael: Bestimmungsschlüssel für in Mitteleuropa heimische und kultivierte Pappelarten und -sorten (Populus spec.) / Michael Koltzenburg. - Abb.; Tab.; Lit. In: Floristische Rundbriefe. Beiheft. - 6 (1999), 53, 28 S. (Themenheft)

Annex 10: Reduction table for slope gradients

%	Degree	Factor	%	Degree	Factor	%	Degree	Factor	%	Degree	Factor
1	0.6	1.000	41	22.3	0.925	81	39.0	0.777	121	50.4	0.637
2	1.1	1.000	42	22.8	0.922	82	39.4	0.773	122	50.7	0.634
3	1.7	1.000	43	23.3	0.919	83	39.7	0.769	123	50.9	0.631
4	2.3	0.999	44	23.7	0.915	84	40.0	0.766	124	51.1	0.628
5	2.9	0.999	45	24.2	0.912	85	40.4	0.762	125	51.3	0.625
6	3.4	0.998	46	24.7	0.908	86	40.7	0.758	126	51.6	0.622
7	4.0	0.998	47	25.2	0.905	87	41.0	0.754	127	51.8	0.619
8	4.6	0.997	48	25.6	0.902	88	41.3	0.751	128	52.0	0.616
9	5.1	0.996	49	26.1	0.898	89	41.7	0.747	129	52.2	0.613
10	5.7	0.995	50	26.6	0.894	90	42.0	0.743	130	52.4	0.610
11	6.3	0.994	51	27.0	0.891	91	42.3	0.740	131	52.6	0.607
12	6.8	0.993	52	27.5	0.887	92	42.6	0.736	132	52.9	0.604
13	7.4	0.992	53	27.9	0.884	93	42.9	0.732	133	53.1	0.601
14	8.0	0.990	54	28.4	0.880	94	43.2	0.729	134	53.3	0.598
15	8.5	0.989	55	28.8	0.876	95	43.5	0.725	135	53.5	0.595
16	9.1	0.987	56	29.2	0.873	96	43.8	0.721	136	53.7	0.592
17	9.6	0.986	57	29.7	0.869	97	44.1	0.718	137	53.9	0.590
18	10.2	0.984	58	30.1	0.865	98	44.4	0.714	138	54.1	0.587
19	10.8	0.982	59	30.5	0.861	99	44.7	0.711	139	54.3	0.584
20	11.3	0.981	60	31.0	0.857	100	45.0	0.707	140	54.5	0.581
21	11.9	0.979	61	31.4	0.854	101	45.3	0.704	141	54.7	0.578
22	12.4	0.977	62	31.8	0.850	102	45.6	0.700	142	54.8	0.576
23	13.0	0.975	63	32.2	0.846	103	45.8	0.697	143	55.0	0.573
24	13.5	0.972	64	32.6	0.842	104	46.1	0.693	144	55.2	0.570
25	14.0	0.970	65	33.0	0.838	105	46.4	0.690	145	55.4	0.568
26	14.6	0.968	66	33.4	0.835	106	46.7	0.686	146	55.6	0.565
27	15.1	0.965	67	33.8	0.831	107	46.9	0.683	147	55.8	0.562
28	15.6	0.963	68	34.2	0.827	108	47.2	0.679	148	56.0	0.560
29	16.2	0.960	69	34.6	0.823	109	47.5	0.676	149	56.1	0.557
30	16.7	0.958	70	35.0	0.819	110	47.7	0.673	150	56.3	0.555
31	17.2	0.955	71	35.4	0.815	111	48.0	0.669	151	56.5	0.552
32	17.7	0.952	72	35.8	0.812	112	48.2	0.666	152	56.7	0.550
33	18.3	0.950	73	36.1	0.808	113	48.5	0.663	153	56.8	0.547

34	18.8	0.947
35	19.3	0.944
36	19.8	0.941
37	20.3	0.938
38	20.8	0.935
39	21.3	0.932
40	21.8	0.928

74	36.5	0.804
75	36.9	0.800
76	37.2	0.796
77	37.6	0.792
78	38.0	0.789
79	38.3	0.785
80	38.7	0.781

114	48.7	0.659
115	49.0	0.656
116	49.2	0.653
117	49.5	0.650
118	49.7	0.647
119	50.0	0.643
120	50.2	0.640

154	57.0	0.545
155	57.2	0.542
156	57.3	0.540
157	57.5	0.537
158	57.7	0.535
159	57.8	0.532
160	58.0	0.530

Annex 11: Tree heigt for leaning trees

	20	30	40	50	60	70	80	90	100	110	120	130	140	150
50	54	58	64	71	78	86	94	103	112	121	130	139	149	158
60	63	67	72	78	85	92	100	108	117	125	134	143	152	162
70	73	76	81	86	92	99	106	114	122	130	139	148	157	166
80	82	85	89	94	100	106	113	120	128	136	144	153	161	170
90	92	95	98	103	108	114	120	127	135	142	150	158	166	175
100	102	104	108	112	117	122	128	135	141	149	156	164	172	180
110	112	114	117	121	125	130	136	142	149	156	163	170	178	186
120	122	124	126	130	134	139	144	150	156	163	170	177	184	192
130	132	133	136	139	143	148	153	158	164	170	177	184	191	198
140	141	143	146	149	152	157	161	166	172	178	184	191	198	205
150	151	153	155	158	162	166	170	175	180	186	192	198	205	212
160	161	163	165	168	171	175	179	184	189	194	200	206	213	219
170	171	173	175	177	180	184	188	192	197	202	208	214	220	227
180	181	182	184	187	190	193	197	201	206	211	216	222	228	234
190	191	192	194	196	199	202	206	210	215	220	225	230	236	242
200	201	202	204	206	209	212	215	219	224	228	233	239	244	250
210	211	212	214	216	218	221	225	228	233	237	242	247	252	258
220	221	222	224	226	228	231	234	238	242	246	251	256	261	266
230	231	232	233	235	238	240	244	247	251	255	259	264	269	275
240	241	242	243	245	247	250	253	256	260	264	268	273	278	283
250	251	252	253	255	257	260	262	266	269	273	277	282	287	292
260	261	262	263	265	267	269	272	275	279	282	286	291	295	300
270	271	272	273	275	277	279	282	285	288	292	295	300	304	309
280	281	282	283	284	286	289	291	294	297	301	305	309	313	318
290	291	292	293	294	296	298	301	304	307	310	314	318	322	326
300	301	301	303	304	306	308	310	313	316	320	323	327	331	335
310	311	311	313	314	316	318	320	323	326	329	332	336	340	344
320	321	321	322	324	326	328	330	332	335	338	342	345	349	353
330	331	331	332	334	335	337	340	342	345	348	351	355	358	362
340	341	341	342	344	345	347	349	352	354	357	361	364	368	372
350	351	351	352	354	355	357	359	361	364	367	370	373	377	381
360	361	361	362	363	365	367	369	371	374	376	379	383	386	390
370	371	371	372	373	375	377	379	381	383	386	389	392	396	399
380	381	381	382	383	385	386	388	391	393	396	398	402	405	409
390	391	391	392	393	395	396	398	400	403	405	408	411	414	418
400	400	401	402	403	404	406	408	410	412	415	418	421	424	427

On flat terrain, the perpendicular height of the tree top above ground level and the horizontal distance of the tree top to the root collar are measured [dm]. The value is then taken from the table via the first column and the header (Pythagoras). On sloping sites, the difference in height between root collar and perpendicular foot under the tree top are taken into account.

	160	170	180	190	200	210	220	230	240	250	260	270	280	290
50	168	177	187	196	206	216	226	235	245	255	265	275	284	294
60	171	180	190	199	209	218	228	238	247	257	267	277	286	296
70	175	184	193	202	212	221	231	240	250	260	269	279	289	298
80	179	188	197	206	215	225	234	244	253	262	272	282	291	301
90	184	192	201	210	219	228	238	247	256	266	275	285	294	304
100	189	197	206	215	224	233	242	251	260	269	279	288	297	307
110	194	202	211	220	228	237	246	255	264	273	282	292	301	310
120	200	208	216	225	233	242	251	259	268	277	286	295	305	314
130	206	214	222	230	239	247	256	264	273	282	291	300	309	318
140	213	220	228	236	244	252	261	269	278	287	295	304	313	322
150	219	227	234	242	250	258	266	275	283	292	300	309	318	326
160	226	233	241	248	256	264	272	280	288	297	305	314	322	331
170	233	240	248	255	262	270	278	286	294	302	311	319	328	336
180	241	248	255	262	269	277	284	292	300	308	316	324	333	341
190	248	255	262	269	276	283	291	298	306	314	322	330	338	347
200	256	262	269	276	283	290	297	305	312	320	328	336	344	352
210	264	270	277	283	290	297	304	311	319	326	334	342	350	358
220	272	278	284	291	297	304	311	318	326	333	341	348	356	364
230	280	286	292	298	305	311	318	325	332	340	347	355	362	370
240	288	294	300	306	312	319	326	332	339	347	354	361	369	376
250	297	302	308	314	320	326	333	340	347	354	361	368	375	383
260	305	311	316	322	328	334	341	347	354	361	368	375	382	389
270	314	319	324	330	336	342	348	355	361	368	375	382	389	396
280	322	328	333	338	344	350	356	362	369	375	382	389	396	403
290	331	336	341	347	352	358	364	370	376	383	389	396	403	410
300	340	345	350	355	361	366	372	378	384	391	397	404	410	417
310	349	354	358	364	369	374	380	386	392	398	405	411	418	424
320	358	362	367	372	377	383	388	394	400	406	412	419	425	432
330	367	371	376	381	386	391	397	402	408	414	420	426	433	439
340	376	380	385	389	394	400	405	410	416	422	428	434	440	447
350	385	389	394	398	403	408	413	419	424	430	436	442	448	455
360	394	398	402	407	412	417	422	427	433	438	444	450	456	462
370	403	407	411	416	421	425	430	436	441	447	452	458	464	470
380	412	416	420	425	429	434	439	444	449	455	460	466	472	478
390	422	425	430	434	438	443	448	453	458	463	469	474	480	486
400	431	435	439	443	447	452	457	461	466	472	477	483	488	494

Annex 12: Maximum tolerances

If at least one of the following tolerance limits is exceeded under average conditions, the *Land* inventory administration may request that the plot be surveyed again or another measure be taken.

- Number of trees in the angle-count sampling with basal area factor 4: no deviation allowed;
- Azimuth to the sample tree in the angle-count sampling (4): tree must still be met;
- Distance to the sample tree in the angle-count sampling (4): half tree diameter, for boundary trees see Chapter 5.5.6;
- Tree height: coniferous trees: ± 5 %; deciduous trees: ± 10 % and max. < 2 m;
- Diameter at breast height: ± 3 mm,
- Upper diameter (D7)): ± 2 cm;
- Number of trees in the sample circle (1 or 2 m circle): ± 1 tree;
- Diameter of deadwood, standing, lying: ± 1 cm, from degree of decomposition 3: ± 2 cm;
- Diameter of deadwood, stumps: ± 2 cm,
- Length of deadwood, lying, under easy conditions: ± 2 dm,
- Number of pieces of deadwood, standing, lying: 0.

Annex 13: Alphabetical list of tree species

Alder, Black	211
Alder, White/Grey	212
Apple, Wild	292
Ash, European	120
Aspen	220
Beech	100
Birch, Downy/Carpathian	201
Birch, European White	200
Cherry, Bird	250
Cherry, Black	252
Cherry, Wild	251
Coniferous Trees, Other	90
Deciduous Trees, Other With A Long Life Expectancy	190
Deciduous Trees, Other With A Short Life Expectancy	290
Douglas fir	40
Elm (*Ulmus glabra, U. minor, U. x. hollandica; U. laevis*)	170
Fir, European Silver	30
Fir, Grand	33
Firs, Other	39
Hornbeam, European	130
Larch, European	50
Larch, Japanese (+Hybr.)	51
Lime Tree (*Tilia cordata, T. platyphyllos, T. x. hollandica*)	150
Maple, Field	142
Maple, Norway	141
Maple, Sycamore	140
Oak, Common	110
Oak, Red	112
Oak, Sessile	111
Pear, Wild	293
Pine, Common	20
Pine, European Black	22
Pine, Mountain	21
Pine, Swiss	24
Pine, Weymouth	25
Pines, Other	29
Poplar, Balsam (+Hybrids)	224
Poplar, European Black	221
Poplar, Grey	222
Poplar, Silver-Leaf/White	223
Robinia	160
Rowan Tree	230
Service Tree	191
Spruce, European	10
Spruce, Sitka	12
Spruces, Other	19
Sweet chestnut	181
Whitebeam	193
Wild Service Tree	295
Willow, Native (*S. aurita, S. caprea, S. alba, S. fragilis, S. x. rubes, S. eleagnos*)	240
Yew	94

Annex 14: Equipment-specific figures

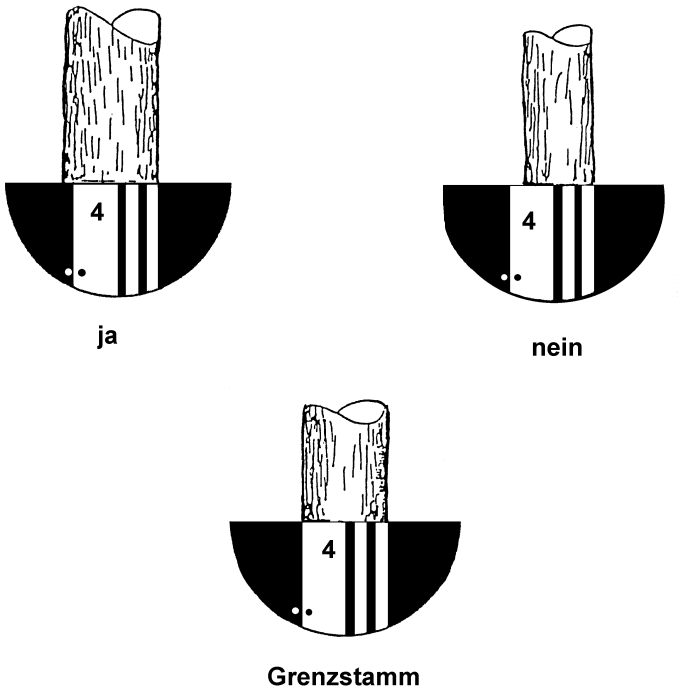


Figure 8: Angle-count sampling with basal area factor 4 through the Relascope

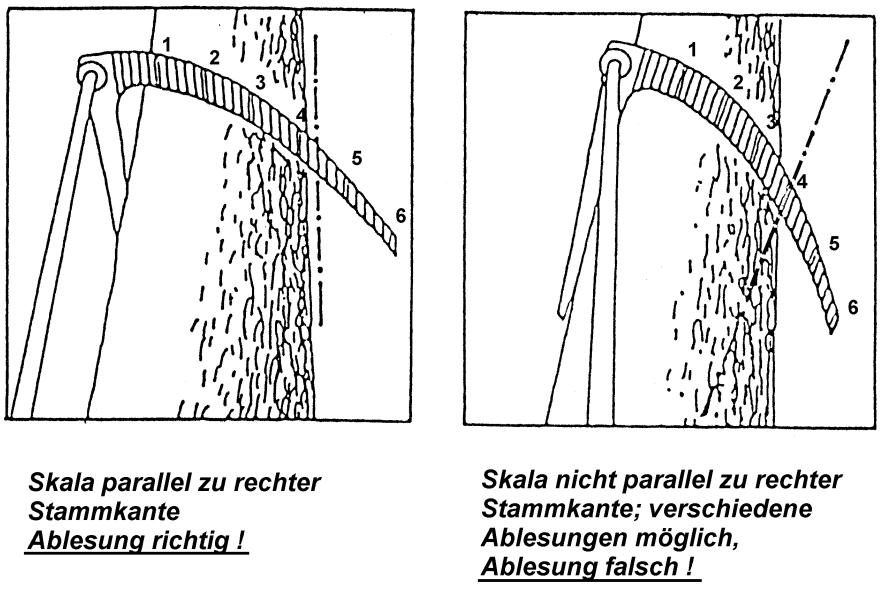


Figure 9: Measuring an upper diameter with the callipers

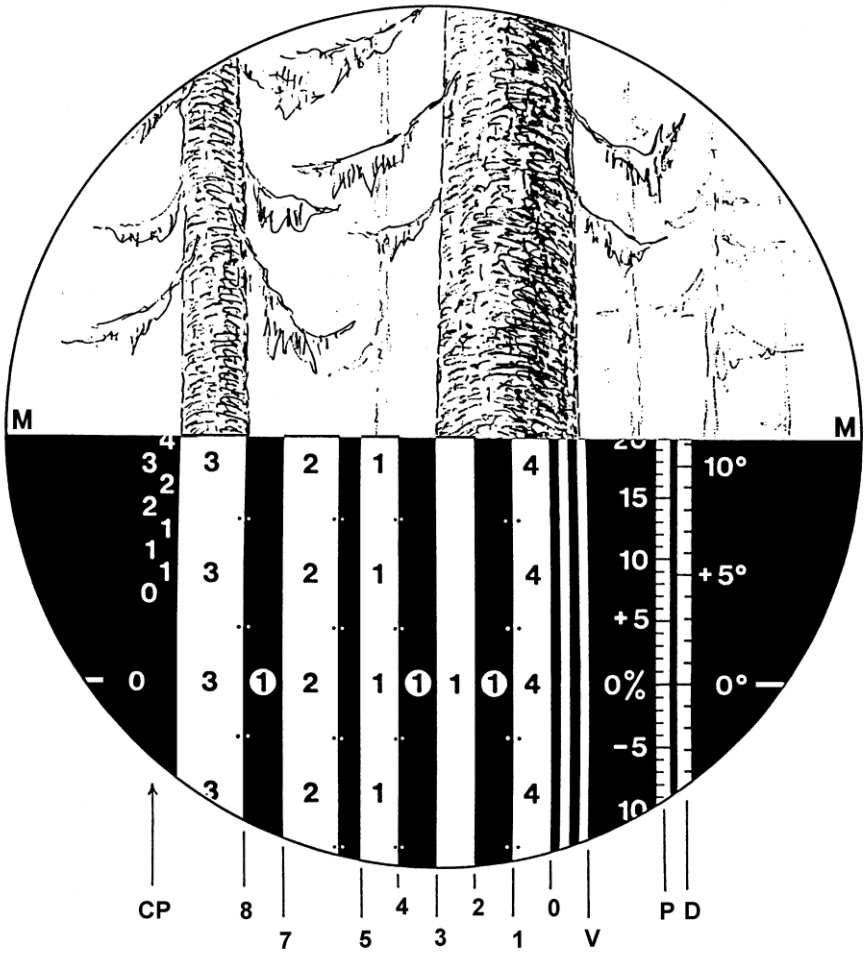


Figure 10: Measuring an upper diameter with the Relascope (Metric CP)

A Relascope unit = 2 % of the horizontal distance from the measuring point to the tree.

If the horizontal distance is 10 m, the targeted stem diameter is 78 cm.

A 1st band in the Relascope represents a diameter of 10 cm at a distance of 5 m and a diameter of 20 cm at a distance of 10 m. The weighted wheel must be loosened for this measurement.

Annex 15: Ordinance on the carrying out of a third National Forest Inventory

Verordnung
über die Durchführung einer dritten Bundeswaldinventur
(Dritte Bundeswaldinventur-Verordnung)

Vom 23. Mai 2007

Auf Grund des § 41a Abs. 4 des Bundeswaldgesetzes vom 2. Mai 1975 (BGBl. I S. 1037), § 41a zuletzt geändert durch Artikel 213 der Verordnung vom 31. Oktober 2006 (BGBl. I S. 2407), verordnet das Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz:

§ 1

Zeitpunkt

In der Zeit vom 1. April 2011 bis zum Ablauf des 31. Dezember 2012 wird eine Bundeswaldinventur durchgeführt. Stichtag für die Auswertung der Daten ist der 1. Oktober 2012.

§ 2

Stichprobenverfahren

Die Bundeswaldinventur ist nach einem einheitlichen terrestrischen Stichprobenverfahren mit gleichmäßig systematischer Stichprobenverteilung über das gesamte Gebiet der Bundesrepublik Deutschland in dem für die Zwecke der Zweiten Bundeswaldinventur-Verordnung vom 28. Mai 1998 (BGBl. I S. 1180) verwendeten 4 x 4 km-Quadratverband durchzuführen. Verdichtungen sind nach Maßgabe der Anlage vorzunehmen.

§ 3

Grunddaten

An den Stichprobenpunkten werden nachstehende Grunddaten gemessen oder beschrieben:

1. Betriebsart,
2. Eigentumsart,
3. Waldstruktur,
4. Baumarten,
5. Alter,
6. Baumdurchmesser,
7. Baumhöhe an ausgewählten Probebäumen,
8. Geländeform,
9. Schäden,
10. Totholz,
11. Bodennutzung auf Nichtholzboden, Aufforstung und Umwandlung.

§ 4

Aufhebung der
Zweiten Bundeswaldinventur-Verordnung

Die Zweite Bundeswaldinventur-Verordnung vom 28. Mai 1998 (BGBl. I S. 1180) wird aufgehoben.

§ 5

Inkrafttreten, Außerkrafttreten

Diese Verordnung tritt am Tage nach der Verkündung in Kraft und mit Ablauf des 31. Dezember 2014 außer Kraft.

Der Bundesrat hat zugestimmt.

Bonn, den 23. Mai 2007

Der Bundesminister
für Ernährung, Landwirtschaft und Verbraucherschutz
Horst Seehofer

Anlage
(zu § 2 Satz 2)

Verdichtung der Bundeswaldinventur

Das Stichprobengrundnetz im 4 x 4 km-Quadratverband ist wie folgt zu verdichten:

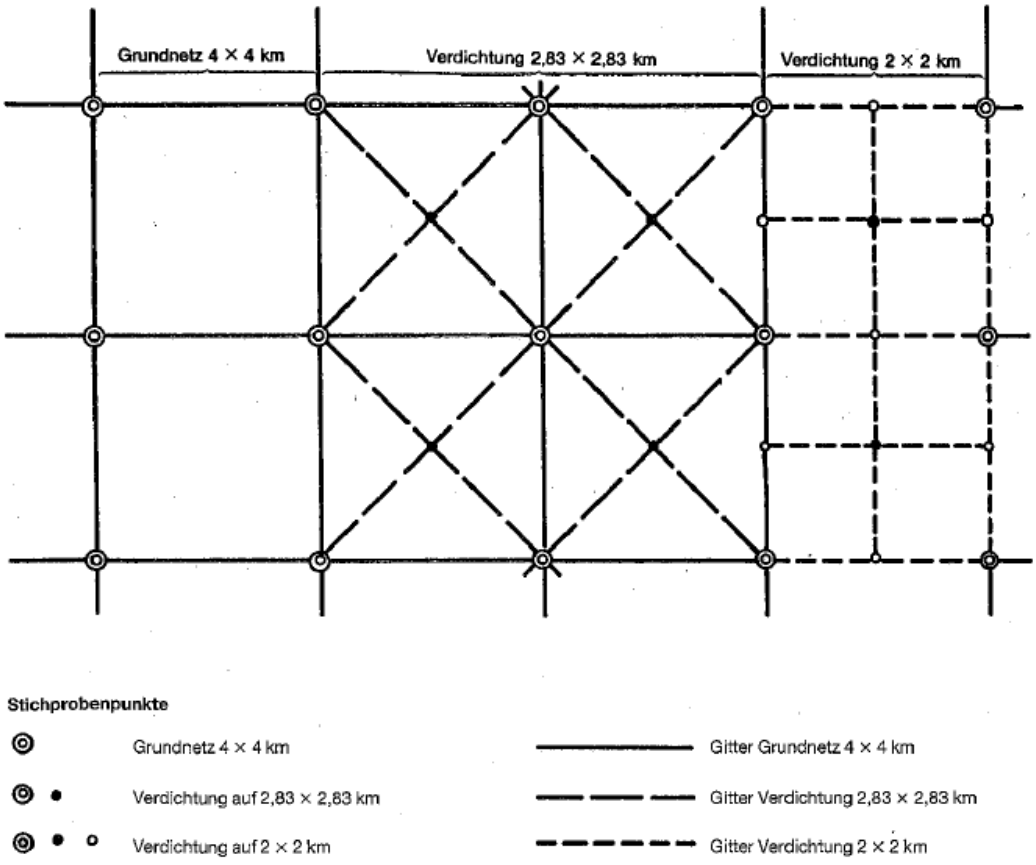
Auf einen 2,83 x 2,83 km-Quadratverband in

- Bayern im Bereich der Regierungsbezirke Schwaben und Mittelfranken,
- Niedersachsen in den Wuchsgebieten Niedersächsischer Küstenraum und Mittel-Westniedersächsisches Tiefland,
- Sachsen,
- Thüringen.

Auf einen 2 x 2 km-Quadratverband in

- Baden-Württemberg,
- Mecklenburg- Vorpommern,
- Rheinland-Pfalz,
- Sachsen-Anhalt,
- Schleswig-Holstein.

Sowohl der 2,83 x 2,83 km-Quadratverband wie auch der 2 x 2 km-Quadratverband sind nach der folgenden Abbildung in das 4 x 4 km-Grundnetz einzupassen:



Annex 16: § 41 a National Forest Inventory

In the version published at the time of the adoption of the ordinance:

Federal Forest Act of 2 May 1975 (Federal Law Gazette I, p. 1037), last amended by Article 213 of the Ordinance of 31 October 2006 (Federal Law Gazette I, p. 2407)

§ 41 a National Forest Inventory

(1) To perform the tasks under this Act, a large-scale forest inventory covering the entire territory of the Federal Republic of Germany shall be conducted on the basis of random sampling (National Forest Inventory). It shall provide an overview of the forest conditions and forest production potential over an extended area. The measurements and descriptions of the state of the forest (basic data) necessary for this purpose shall be undertaken in accordance with a uniform procedure. If required, the inventory shall be repeated.

(2) The *Länder* shall collect the basic data referred to in paragraph 1; the Federal Ministry of Food, Agriculture and Consumer Protection shall compile and evaluate these data.

(3) The persons assigned the task of preparing and conducting the National Forest Inventory shall be entitled, to perform their duties, to enter land and to carry out the necessary work for the inventory on this land.

(4) The Federal Ministry of Food, Agriculture and Consumer Protection shall be empowered, by statutory order with the consent of the Bundesrat, to determine the time of the National Forest Inventory and to adopt detailed provisions on the sampling procedure to be used according to paragraph 1 and the basic data to be communicated.

In the current version:

Federal Forest Act of 2 May 1975 (Federal Law Gazette I, p. 1037), last amended by the Second Act amending the Federal Forest Act of 31 July 2010 (Federal Law Gazette I, p. 1050)

§ 41 a Forest surveys

(1) To perform the tasks under this Act and to implement legal instruments of the European Union or agreements within the scope of the Act that are binding under international law, with reservation made for paragraph 3, a large-scale forest inventory covering the entire territory of the Federal Republic of Germany shall be conducted every ten years on the basis of random sampling (National Forest Inventory). It shall provide an overview of the forest conditions and forest production potential over an extended area. The measurements and descriptions of the state of the forest (basic data) necessary for this purpose shall be undertaken in accordance with a uniform procedure. The exploitability of the basic data, also within the scope of the observation under § 6 Federal Nature Conservation Act, shall be taken into account in this context.

(2) The *Länder* shall collect the basic data referred to in paragraph 1; the Federal Ministry of Food, Agriculture and Consumer Protection shall compile and evaluate these data.

(3) To meet reporting obligations based on climate protection agreements that are binding under international law, the Federal Ministry of Food, Agriculture and Consumer Protection shall, if required, collect data on forest carbon stocks in the years between two national forest inventories.

(4) The persons assigned the task of preparing and conducting the forest surveys mentioned in paragraph 1 and 3 and in the ordinances under paragraph 6 are entitled, to perform their duties, to enter land and to carry out the necessary data collection and samping work on this land.

(5) The Federal Ministry of Food, Agriculture and Consumer Protection shall be empowered, by statutory order with the consent of the Bundesrat, to adopt detailed provisions on the sampling procedure to be used for the national forest inventory and on the basic data to be communicated.

(6) The Federal Ministry of Food, Agriculture and Consumer Protection may stipulate by way of ordinance, with the consent of the Bundesrat, that data

1. on the nutrient supply and the pollution of the forest soils (forest soil survey),

2. on the vitality of the forests,

3. on the interactions in forest ecosystems

can be collected and, in this context, may also adopt detailed provisions on the time, the procedures to be followed and the basic data to be communicated. In the case of an ordinance under the first sentence, paragraph 2 shall apply accordingly.