Methodology for Recording and Assessing FFH Forest Habitat Types in the Scope of the 3rd National Forest Inventory (NFI 2012)

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The *Länder* Working Group on Nature Conservation (LANA) and the Forest Directors' Conference (FCK) adopted an earlier version of this methodology for recording forest habitat types:

(a) FCK meeting on 12/13 November 2009, FCK meeting on 23/24 April 2013,

(b) 101st LANA meeting in Schwerin on 4/5 March 2010.

Abstract

Article 11 of the Habitats Directive mandates the implementation of nationwide monitoring, inter alia, of the conservation status of habitat types in the Member States. In Germany, the Federal Government/*Länder* Working Group on Nature Conservation, Landscape Management and Recreation (LANA) asked the Forest Directors' Conference (FCK) to supplement the National Forest Inventory with a methodology for recording and assessing prevalent forest habitat types for the national FFH report, thus making use of interdepartmental synergy effects. The scheme described herein presents a methodology for recording and assessing common or widespread FFH forest habitat types within the scope of the third National Forest Inventory (NFI 2012). It takes into account the requirements of the EU and the LANA-FCK paper of 2004. While the nationwide FFH monitoring and the National FFH Report provide for conclusions concerning the conservation status of each forest habitat type at the level of the biogeographic regions in Germany as a whole, they do not allow conclusions at the level of the *Länder* or with respect to even smaller subareas such as individual FFH areas. By implementing the scheme described here, the *Länder* can use the monitoring system in place for their contribution to the German FFH reporting obligation on forest habitat types.

The methodology was adopted by the FCK and LANA and incorporated in the NFI procedure by the Federal Government and the *Länder*. The survey outcome was incorporated into the 2013 national FFH report. As a follow-up to the NFI 2012, the description of the methodology has been updated.

Keywords: Habitats Directive, forest habitat types, National Forest Inventory, recording methodology, assessment, specific structures and functions

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1. Motive, specifications, mission, further steps

1.1. The FFH surveillance and national FFH reporting obligations

Under the EU Habitats Directive, the conservation status of the habitat types and species is to be monitored and assessed separately for each biogeographic region (BGR). This paper shows how the data for the assessment of the conservation status of the forest habitat types that frequently occur in Germany can be collected with reasonable effort in the scope of the National Forest Inventory (NFI).

Under Article 17 in conjunction with Article 11 of the Habitats Directive, the Member States (MS) must draw up a report every six years for the EU Commission (COM) on the conservation status of the habitat types and species protected under the Directive (FFH habitat types and FFH species). Article 11 of the Habitats Directive requires EU Member States to monitor the conservation status. In 2007, a monitoring system was introduced to collect data on the conservation status of the habitat types and species protected under the Habitats Directive in the Atlantic and the Continental biogeographic regions in Germany for the national FFH report. The concept for this methodologically demanding task was developed in the scope of research projects of the Federal Agency for Nature Conservation (BfN) (see e.g. Sachteleben & Behrens 2010). The report to the

COM must be made at intervals of every six years (report: 2007 for the period 2001-2006; following report: 2007-2012 in 2013) and will be drawn up on the basis of the respective latest data. The EU did not set down any methodical requirements for the survey methods, but does recommend the use of random sampling methods for prevalent or widespread protected habitats and species. It leaves the design of surveillance largely to the MS, but does set down a binding format for the report in a position paper by the Habitat Committee (DocHab-04-03/03 rev. 3, EU Commission (2005) or updated version DocHab-11-05/03, EU Commission (2011)).

According to the EU requirements (DocHab-04-03/03 rev. 3 or DocHab-11-05/03) data must be aggregated and assessed according to a colour code (red = unfavourable – bad, amber = unfavourable – inadequate, green = favourable) at the BGR level for each habitat type in order to assess their conservation status according to the following parameters:

Table 1: Parameters for assessing the conservation status of the forest habitat types and related data collected in the scope of the NFI

Parameters per BGR	**Description (in relation to the NFI)**
"Range" and "Favourable reference range"	Present range (total size in km²) of the habitat type in the form of a distribution map (outer borders of the range) and trend of the range
"Area covered" and "Favourable reference area"	Area actually taken up by the habitat type in ha, shown also as grid distribution map and trend
"Specific structures & functions incl. typical species"	Relevant structural parameters (to be defined by the MS, e.g. deadwood stock, development stages in forest) and occurrence of typical tree species and other species
"Future prospects"	Expert assessment on the future development of the habitat type with regard to hazards, pressures and long-term viability

1.2. Potential synergies between the FFH reporting obligation and the NFI

There are considerable parallels/intersections between the NFI and the FFH surveillance and reporting obligation, in particular:

- comprehensive nationwide approach,
- random-sample based procedure,
- periodical repetition of the surveys within comparable time periods,
- the NFI already surveys many of the characteristics required for the FFH assessment of forest habitat types.

A proposal was drawn up on how the NFI results can contribute to fulfilling the FFH reporting obligations. Possible advantages of using NFI data for the national FFH reports are:

- conclusive, reliable, statistically verified data to fulfil Germany's reporting obligation,
- for prevalent forest habitat types, it largely covers the assessment parameters required by the DocHab: range (in part), area covered (in part), specific structures and functions (incl. habitat-typical species),
- recorded by forestry personnel (use of available competence),
- cost savings over a newly established random sampling system e.g. by the nature conservation administrations,
- less state surveys needed in privately-owned forests (consolidation), thereby less effort for coordination with property owners and associations,
- uniform methodology in all *Länder*,
- uniform training of survey teams,
- use of existing networks for implementation,
- robust assessment basis for significantly-sized forest habitat types due to high number of random samples,
- use of the existing acceptance of the NFI as a known instrument among forest owners,
- availability of data series from NFI 1987 and NFI 2002 for the attributes already surveyed for them (for retrospective evaluations, time series),
- FFH reporting obligation as an additional use of NFI data as prescribed by Section 41a (1) of the Federal Forest Act stipulating that the exploitability of the basic data, also within the scope of the observation under Section 6 of the Federal Nature Conservation Act (nature conservation monitoring), shall be taken into account in the scope of the National Forest Inventories.

These synergies were used during the NFI 2012 procedure. However, the forest habitat type surveillance required additional survey attributes in the scope of the NFI 2012. This additional expense was offset by savings in the "63 samples" system (concept proposed by the BfN and the *Länder* nature conservation authorities, see Sachteleben & Behrens 2010).

2. Designation of forest habitat types

2.1. Forest habitat types that can/should be processed in NFI 2012

The *Länder* have agreed[1] to examine whether the cross-*Länder* surveillance and linked provision of data for the national FFH reports on forest habitat types under Article 11 and 17 of the Habitats Directive in all three biogeographic regions of Germany can be fulfilled with the NFI 2012. This postulates a statistically sufficiently precise survey of a forest habitat type in the respective biogeographic region.

Forest habitat types that can only be inadequately surveyed by the NFI will have to be handled using other suitable surveys outside the NFI. The following rule applies: The larger the area of a biogeographic region within Germany, the fewer forest habitat types are affected by this. For the Alpine region, which in Germany is only in parts of Bavaria, NFI 2012 data have not been used as Bavaria has directly made available the assessment results for all forest habitat types occurring there.

The following list contains the area information for the forest habitat types of the *Länder* from the 2007 national FFH report (Table 2). The statistical certainty of the data depends on the number of samples taken and the variance of the attribute observed. Before the NFI 2012 it was also unknown which sample figures will be attained in the forest habitat types in the individual biogeographic regions. The five largest forest habitat types alone take up 82% of the area of all forest habitat types occurring in Germany. For these particularly frequent forest habitat types, at the least, statistically verified data could be used for calculations in the lead-up to the NFI 2012.

[1] E.g. at the Federal-*Länder* authorities meeting in preparation for the Third National Forest Inventory on 19/20 September 2006, BMELV, Bonn, and fundamental agreement of the FCK for the forest habitat type survey during the NFI in May 2008.

Table 2: Forest habitat types and their area according to the national FFH report 2007; for forest habitat types with area data marked in green, statistically verified data could be used in the in the lead-up to the NFI 2012.

Forest habitat type		Area per BGR in ha			*Area over all BGR in ha*	Percentage of the total area of all forest habitat types in Germany
		Atl.	Cont.	Alp.		
Asperulo-Fagetum beech	9130	21,311	660,832	60,000	*742,143*	42.5
Luzulo-Fagetum beech	9110	25,719	590,406	800	*616,925*	35.3
Ilex-B. incl.	(9120)	650	190			
Alluvial f. with *Alnus glutinosa* and *Fraxinus excelsior*	91E0	7,671	60,282	2,100	*70,053*	4.0
Galio-Carpinetum oak-hornbeam	9170	2,056	66,487	-	*68,543*	3.9
Sub-Atlantic and medio-European oak or oak-hornbeam f. of the *Carpinion betuli*	9160	23,531	29,340	-	*52,871*	3.0
Acidophilous *Picea* f. of the montane to alpine levels	9410	-	44,600	5,000	*49,600*	2.8
Bog woodland	91D0	21,815	19,814	380	*42,010*	2.4
Medio-European limestone beech forests of the *Cephalanthero-Fagion*	9150	65	32,329	1,050	*33,444*	1.9
Old acidophilous oak woods with *Quercus robur* on sandy plains	9190	13,993	14,555	-	*28,548*	1.6
Tilio-Acerion ravine f. of slopes, screes and ravines	9180	-	21,096	1,200	*22,296*	1.3
Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*	91F0	586	13,426	-	*14,012*	0.8
Wooded dunes of the Atlantic, Continental and Boreal region	2180	210	3,947	-	*3,947*	0.2
Medio-European subalpine beech woods with *Acer* and *Rumex arifolius*	9140	-	804	900	*1,704*	0.1
Alpine *Larix decidua* and/or *Pinus cembra* f.	9420	-	-	1,300	*1,300*	0.1
Central European lichen pine f.	91T0	6	426	-	*432*	0.0
Sarmatic steppe pine f.	91U0	-	277	-	*277*	0.0
Pannonic woods with *Quercus petraea* and *Carpinus betulus*	91G0	-	74	-	*74*	0.0
Subalpine and montane *Pinus uncinata* f.	9430	does not occur in D				0.0
All forest habitat types					***1,748,179***	100.0

The reports for the forest habitat types that cannot be assessed with the help of NFI 2012 data will have to be prepared on the basis of national FFH surveillance by the nature conservation administrations. Since this does not fulfil all of the criteria of the DocHab, however, further data sources in particular with regard to the area and range will have to be used.

<u>For formal reasons, the following forest habitat types are not handled in the scope of the NFI:</u>

- *4070 Bushes with *Pinus mugo* and *Rhododendron hirsutum* is not forest as defined by the NFI and therefore not an object of the NFI.

- *9430 Subalpine and montane *Pinus uncinata* forests are not expected for Germany by the COM; the forest habitat type can, at the request of Bavaria, be allowed for as a *Land* attribute for Bavaria, if necessary, but due its small area will not be handled in the scope of the NFI.[1]

Forest habitat type 9120 Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer is allocated to forest habitat type 9110 due to negligible percentage of area and great similarity with forest habitat type 9110 (see also the BfN manual by Ssymank et al. 1998, p. 337). Forest habitat type 9120 only occurs in the EU-Atlantic regions of Europe (this does not mean the Atlantic BGR). Reports by some German *Länder* under this forest habitat type number were accepted by the COM, but, for technical reasons, should in future be allocated to forest habitat type 9110.

Forest habitat type 91G0 is extremely rare in Germany. Its survey in the scope of the NFI could therefore not be expected. Forest habitat type 91G0 is – with regard to forest structure and species composition – closely related to forest habitat type 9170, and occurrences of this habitat type can therefore be classified as forest habitat type 9170 occurrences.

[1] COM struck this forest habitat type from the German list since it anticipates that only *pinus uncinata* hybrid forms occur in Germany. The dominant tree species must be *Pinus uncinata*. Winter heath-pine forests with dominant *Pinus sylvestris* do not belong to this habitat type. There has so far been no reporting obligation for forests with *Pinus uncinata* in Bavaria as this habitat type is currently not part of the EU checklist for Germany. But the genetic status of the *Pinus uncinata* occurrence in Bavaria requires further verification.

For technical reasons, the following forest habitat types are not surveyed by the NFI:

The forest habitat types 91T0 and 91U0 are so rare in Germany that they are by no means surveyed with sufficient frequency by the NFI. Due to pine dominance, they can only be differentiated from other pine forest habitat types or forests that are not forest habitat types through soil vegetation attributes. Because of this unfavourable cost-benefit ratio they are not handled in the NFI.

Subtypes:

During surveillance, differentiating the EU subtypes is necessary for some forest habitat types as otherwise the tree species composition cannot be expediently assessed. The LANA Standing Committee on policy issues and Natura 2000 decided in 2007 that the national FFH report would be prepared at the level of the forest habitat types. Subtypes are therefore summarised for the report.

In the case of linear forest habitat types that do not fulfil the forest definition, possibly because of their small width (e.g. Code 91E0 as alder gallery forests along watercourses), the NFI can only survey the part that is classified as forest. Parts that are not surveyed must be assessed via expert vote or via additional data from the nature conservation administrations.

The forest habitat types are surveyed according to the list in

Table 3.

Table 3: NFI and FFH codes of the forest habitat types (BMELV, 2011, Chapter 5.7.5)

NFI code	FFH code	Names of forest habitat types
0	0	Not a forest habitat type
2180	2180	Wooded dunes of the Atlantic, Continental and Boreal region
9110	9110	*Luzulo-Fagetum* beech forests
9130	9130	*Asperulo-Fagetum* beech forests
9140	9140	Medio-European subalpine beech woods with *Acer* and *Rumex arifolius* (only in high montane or subalpine altitude)
9150	9150	Medio-European limestone beech forests of the *Cephalanthero-Fagion* (only on southerly, south-westerly or south-easterly slopes)
9160	9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli* (*Stellario-Carpinetum* oak-hornbeam forests)
9170	9170	*Galio-Carpinetum* oak-hornbeam forests
9180	*9180	*Tilio-Acerion* forests of slopes, screes and ravines
9190	9190	Old acidophilous oak woods with *Quercus robur* on sandy plains
9210	*91D0	Bog woodland[1]
9211	*91D1	*Sphagnum* birch woods
9212	*91D2	Scots pine mire woods
9213	*91D3	Mountain pine bog woods
9214	*91D4	Mire spruce woods
9220	*91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
9230	91F0	Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers
9240	*91G0	Pannonic forests with *Quercus petraea* and *Carpinus betulus*
9410	9410	Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*)
9420	9420	Alpine *Larix decidua* and/or *Pinus cembra* forests

* priority forest habitat type

[1] only used if none of the four subtypes can be allocated

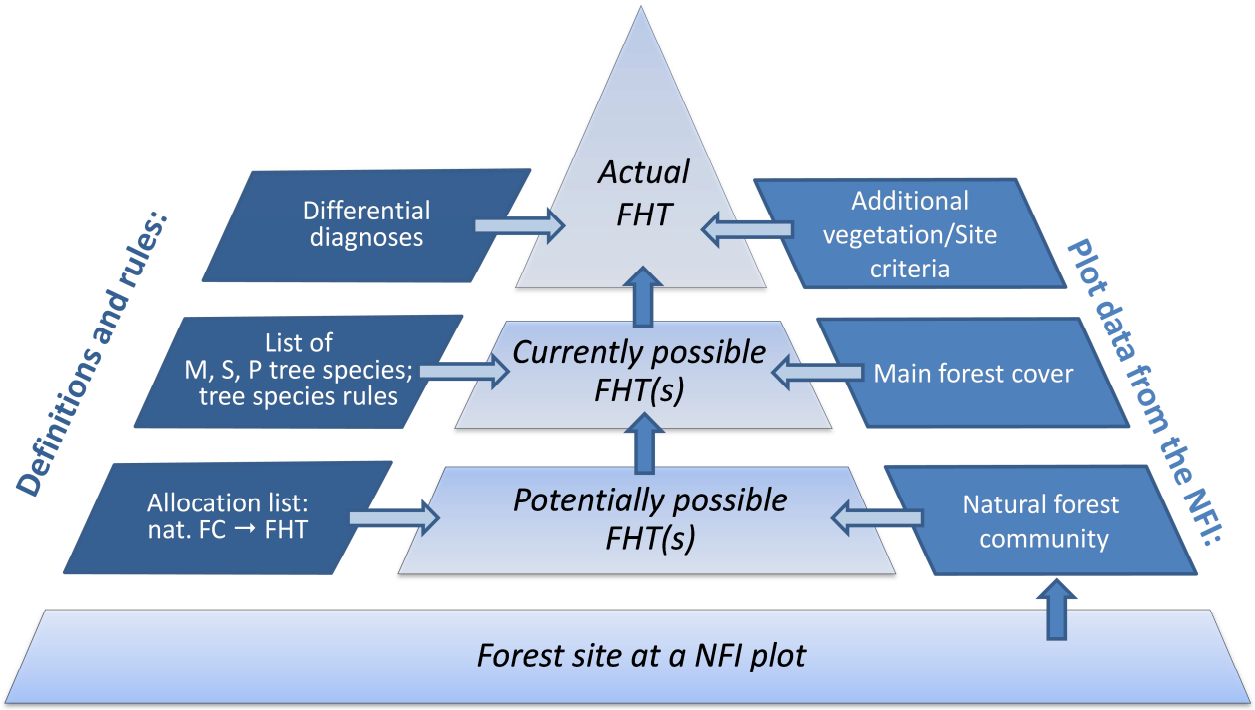
2.2. Range

The range and the area covered by a forest habitat type in a biogeographic region are determined by reports from the nature conservation authorities of the *Länder*. These reports should be complemented by NFI data on the occurrence of forest habitat types and nationwide statistical estimates based on these data[1]. By comparing the changes with a previous survey, the trend for these two partial criteria can be estimated during the following NFIs. The NFI 2012 area data have not been used for the national FFH report 2013.

2.3. Designation of a forest habitat type at a plot

The forest habitat type at a plot is designated in four steps (Figure 1):

Figure 1: Overview showing the method used for the designation of a forest habitat type at an NFI plot. Abbreviations used: M, S, P = main, secondary and pioneer tree species; nat. FC = natural forest community; FHT = forest habitat type.



[1] BfN method according to EU requirements as coordinated with the *Länder*

2.3.1. Step 1: Designation of the site

The designation of a forest habitat type starts with the designation of the site at a plot.

Location information forms an important basis to determine the natural forest community and the forest habitat type. The *Länder* integrate the location information on their respective area, as far as possible, into the decision-making process to designate the natural forest communities and forest habitat types. From a technical standpoint, location information should be made available for each *Land* from one source that is at a scale of at least 1 : 10,000 (better 1 : 5,000) for each plot to ascertain and check the natural forest community (and therefore also the forest habitat type). The procedure would be documented in the free text so that the decision is traceable.

For the NFI 2012, location information from the *Länder* was available to differing extents and in different quality. Uniform nationwide, finely scaled location information that could be used in the scope of the standard collection process for forest habitat type designation would improve the correct designation of forest habitat types, especially in exceptional cases and in cases of doubt, and appear to be a sound investment in the NFI sampling grid for future surveys.

2.3.2. Step 2: Designation of the natural forest community and of the potentially possible forest habitat types

The location designates the natural forest community as defined by the NFI (tree species composition of the present potential natural vegetation).

The natural forest community at a plot has been derived by the *Länder*. Due to the different state of knowledge about this area information in the *Länder*, different sources of information such as forestry site maps, soil maps and maps showing the protected forest communities and forest habitat types were used. For future NFI surveys, this important basic information should be consolidated for algorithmic allocation by the *Land* inventory administrations and the national inventory administration.

The BfN and the *Länder* have prepared an allocation list (Appendix 3) for natural forest communities and forest habitat types.

24 natural forest communities are directly allocated to one specific forest habitat type, whereas in ten natural forest communities several forest habitat types can occur. Seven natural forest communities are not allocated to any forest habitat type. It is therefore known for each survey unit which forest habitat type(s) could potentially occur there.

2.3.3. Step 3: Designation of the currently possible forest habitat types

To designate the currently possible forest habitat types it is then examined in the next step whether the tree species in the main forest cover (for definition see Chapter 3.1.3) are a main, (M), secondary (S) or pioneer (P) tree species for the potentially possible forest habitat type(s). There must be a minimum percentage of M, S and P. A distinction is made between the different forest development phases (for definition see Table 4).

Table 4: Development phases

Development phase	Designation	DBH
Development phase 1	Temporarily unstocked area to pole-sized stands	< 20 cm
Development phase 2	Marginal timber stand	≥ 20 cm to < 35 cm
Development phase 3	Medium timber stand	≥ 35 cm to < 50 cm
Development phase 4	Strong timber stand	≥ 50 cm to < 70 cm
Development phase 5	Very strong timber stand	≥ 70 cm

Lower minimum percentages apply to forest development phase 1. Forest development phase 1 with almost exclusive participation of pioneer tree species is – or can be – a natural element of the forest dynamics of habitat types. It is therefore assessed as belonging to a forest habitat type if the climax tree species of this forest habitat type already occur in relatively low percentages and if the natural pioneer tree species dominate this site.

A further condition is that in deciduous tree-dominated forest habitat types, the percentage of coniferous trees must be ≤ 50 % (see Table 5).

Table 5: Rules for the designation of the currently possible forest habitat types

	Forest habitat type if	Restriction
1.	M ≥ 30 % and M + S ≥ 50 % and M + S + P ≥ 70 %	Forest development phases 2-5
2.	M + S + P ≥ 70 % and M ≥ 10 %	Forest development phase 1
3.	Sum of coniferous trees max. 50 %	in deciduous tree-dominated forest habitat types (all except 91D2, 91D3, 91D4, 9410 and 9420)

The stipulation that the forest cover must primarily have arisen from natural regeneration has been discarded, as information about the original species is rarely available.

The M, S and P tree species were allocated to the forest habitat types, differentiated by region. This differentiation took place at the level of the forest biogeoclimatic zones, the forest biogeo-climatic subzones and the altitudinal zones according to the natural occurrence (natural areas) of

the tree species and their significance in the forest habitat types. The *Länder* have drawn up a catalogue of the M, S and P tree species for the forest habitat types and harmonised the information at *Land* borders. The tree species data of the mapping instructions of the *Länder* have been incorporated in this catalogue. The catalogue is decisive for the continuing work. Tree species lists in, for example, mapping instructions or manuals cannot be later consulted by the team on site. This work – apart from some minor revisions – was completed with the Federal and *Länder* authorities meeting from 10-13 February 2009 in Eberswalde (for data record see Appendix 5: Regionalised database of tree species of the forest habitat types by M, S, P).

Tree species can simultaneously belong to both "S" and "P" when a tree species is both a typical pioneer of the forest habitat type (in this region/altitudinal zone, etc.) and also occurs in later phases of forest development naturally as a mixed tree species (example: the European Ash as pioneer and mixed tree species in forest habitat type 9130 on shell limestone).

In Germany, tree species cannot be habitat-typical tree species outside of their natural range (including the altitudinal zone). This explicitly also applies if they are naturalised or considered native in Germany.

Conifer species cannot be the main tree species in deciduous-dominated forest habitat types (all with the exception of 91D2, 91D3, 91D4, 9410 and 9420).

2.3.4. Step 4: Designation of the actual forest habitat type at a plot

2.3.4.1. Basic rule

The actual forest habitat type at a plot is clearly designated if the tree species composition only allows for one currently possible forest habitat type and if all other requirements with regard to the ground vegetation, if applicable, are met (see Chapter 2.3.4.3). If the tree species composition allows for several currently possible forest habitat types, additional attributes must be surveyed at the plot (see Chapter 2.3.4.3) or a differential diagnosis must be carried out if necessary (see Chapter 2.3.4.4). Bog forest habitat types constitute a special case (see Chapter 2.3.4.2).

2.3.4.2. The special case of bog forest habitat types

In a bog forest habitat type, additional attributes must be surveyed at the plot to confirm the forest habitat type (Table 6).

Table 6: Rules for the confirmation of a bog forest habitat type

	Bog forest habitat type if	Restriction
	≥ 30 cm peat thickness	only in 91Dx
	≥ 5 % coverage peat mosses	only in 91Dx
	≥ one species from the list bog species[1]	only in 91Dx

2.3.4.3. Survey of additional attributes

Additional attributes are surveyed at the plot and further reduce the number of currently possible forest habitat types. The following criteria are required for the differential diagnosis:

Table 7: Additional attributes to reduce the number of currently possible forest habitat types

	Forest habitat type if	Restriction
1.	Occurrence of an oak-hornbeam (*Carpinion*) species in the r = 10 m circle[2]	in secondary 9160 or 9170
2.	In addition to the occurrence of an oak and/or hornbeam species, occurrence of at least one species from the following tree species list: lime tree, wild cherry, black alder, ash, field maple, elm	in secondary 9160
3.	In addition to the occurrence of an oak and/or hornbeam species, occurrence of at least one species from the following tree species list: lime tree, wild cherry, wild service tree, ash, field maple, whitebeam, wild pear, service tree, aspen	in secondary 9170
4.	No occurrence of oak-hornbeam species in the r = 10 m circle[2]	in secondary 9190
5.	Differential species for forest habitat type 9160 or 9170 or other plausible differential attribute (site maps) found	for decision whether 9160 or 9170
6.	Sandy soils without solid bedrock at the surface	in secondary 9190
7.	Periodically dry to periodically wet sites with moor grass (*Molina coerulea*) or Occurrence 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 other sound basis (habitat maps, biotope maps, site maps, separate visual inspection by experts)	in secondary 9190
8.	Proximity to the sea (continuous area of land up to a distance of 10 km) and only on coastal dunes	in 2180

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

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

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 BfN definition, stands situated in isolation from the coast do not belong to forest habitat type 2180 but to other forest habitat types depending on their tree species composition. In Lower Saxony forest habitat type 2180 can occur up to 10 km from the coast. In Schleswig-Holstein forest habitat type 2180 is located in the forest biogeoclimatic subzones of the northern downs, central downs and in the forest biogeoclimatic zones of the west coast marshes and islands. In January 2009 Mecklenburg-Western Pomerania reported the forest biogeoclimatic zones Mecklenburg-Westvorpommern coastland and Ostvorpommern coastland.

If the forest cover on a coastal dune close to the sea corresponds to forest habitat type 2180[1], this forest habitat type is considered the actual forest habitat type even if other forest habitat types would currently also be possible.

Field attribute 'ground vegetation'

If the allocation to a forest habitat type is unambiguous on the basis of the information available on the natural forest community and the tree species composition, as well as the location information, knowledge about the ground vegetation is not necessary for the designation.

In order to rule out a forest habitat type at a sample plot, typical plant species of the ground vegetation must be considered and documented on a case-by-case basis. This applies to the forest habitat types 9160, 9170 and 9190. If typical plant species of the ground vegetation cannot – or not sufficiently – be surveyed, e.g. for seasonal reasons, the result of the allocation of a plot to a forest habitat type might have to be verified in these cases. Plant species that only occur due to anthropogenic disruptions in the soil structure (e.g. tyre tracks) are not taken into consideration. For this purpose, the team surveys the ground vegetation according to a list of differentiating species if other suitable information, e.g. on the location, are lacking (see BMELV 2011, Chapters 5.7.5.3 and 5.7.5.4 and Appendix 4).

The lists of the differentiating plant species may be regionalised since an indicator characteristic of one species may change regionally in Germany. In the cases of some taxa this differentiation only ranges to the genus (e.g. in peat mosses of the *Sphagnum* genus).

[1] Forest habitat type 2180 is extremely broad in scope. It includes different forest communities and does not differentiate between main, secondary and pioneer tree species.

2.3.4.4. Differential diagnosis / Tests

If additional attributes do not suffice for the designation of the actual forest habitat type, differential diagnoses / tests within the group of the remaining currently possible forest habitat types must be carried out (see Table 8).

Table 8: Differential diagnosis / Tests

	Rule / Condition	Restriction
1.	Rule of dominance (see explanations in the following text)	only in 91Dx
2.	Beech < 10 % in the main forest cover ...	in 9160 or in part of area not dominated by Atlantic climate of 9190 (only at secondary locations natural forest communities 1-6)
3.	Beech < 30 % in the main forest cover ...	in 9170 or in part of area dominated by Atlantic climate of 9190[1] (only at secondary locations, natural forest communities 1-7, 39)
4.	If beech < 30 % and ≥ oak, then beech forest habitat type	in 9170 or in part of area dominated by Atlantic climate of 9190 and in development phase 1 (only at secondary locations, natural forest communities 1-7, 39)
5.	If beech < 30 % and < oak, then 9170 or 9190	in 9170 or in part of area dominated by Atlantic climate of 9190 and in development phase 1 (only at secondary locations, natural forest communities 1-7, 39)
6.	In case of doubt between 9180 and 91G0: → 9180 9170 and 91F0: → 9170 9110 and 9410: → 9410	

The rule of dominance is a method of designating the habitat subtype of bog forest habitat types. If a number of subtypes come into consideration, the following procedure is taken:

- If mountain pine (*pinus mugo*)/*Pinus mugo subsp. uncinata* occurs, 91D3 wins out over the other habitat subtypes, since it is the only one of the habitat subtypes where practically no planting was ever done.

- Otherwise whatever tree species dominates in number determines the type. If the numbers are equal, that tree species is chosen with less suspicion of forestry influence: White birch > Scots pine > spruce (white birch is more type determining than Scots pine is more type determining than spruce).

[1] The Atlantic region encompasses the *Länder* Mecklenburg-Western Pomerania, Schleswig-Holstein, Hamburg, Bremen and Lower Saxony.

In secondary oak forest habitat types, the occurrence of beech shows that the location conditions that characterise the definition of primary oak forest habitat types are not given:

9160: Hygromorphy, high groundwater level (according to the Habitat manual),

9170: Warm, dry locations that are not periodically wet.

For secondary oak forest habitat types, beech percentages of up to < 30 % are therefore permissible; beech percentages ≥ 30 %, on the other hand, clearly indicate beech forest habitat types.

2.3.5. Forest habitat type algorithm

To support the work of the survey teams, a forest habitat type algorithm has been programmed, which contains the rules, definitions and necessary arithmetic steps for the designation of the actual forest habitat type. The algorithm is embedded in the NFI data collection program. All information relevant for identification of the actual forest habitat type is traceably stored by the collection software. The survey team receives error messages if necessary attributes and criteria for the designation of the forest habitat type are missing.

The program provides the following interim results for the designation of forest habitat types (see Table 9):

Table 9: List of interim results displayed for the selection of forest habitat types in the NFI data collection program.

Interim result	Field name in the NFI data collection program
Potentially possible forest habitat types	WLT_Liste
Currently possible forest habitat types	WLT_ListeA
List of the currently possible forest habitat types, reduced after having taken additional attributes into account	WLT_ListeB
List of the currently possible forest habitat types, reduced after having taken additional attributes into account and after differential diagnoses / tests	WLT_ListeC
Actual forest habitat type	WLT

The technical implementation is set out in Appendix 6: Forest habitat type algorithm: flow chart.

3. Assessment

Assessment attributes are only recorded when a forest habitat type occurs at the sample point. In the NFI 2012, this was the case at 18 % of all plots in the forest.

The determination of an assessment procedure encompasses:

- Definition of the attributes,
- Assessment thresholds of the attribute values,
- Weighting of the attributes when indicated,
- Compiling the point information or assessments to reach a conclusion for the forest habitat type at the level of the biogeographic regions or the physiographic large-scale regions (aggregation method, possibly including rules for carrying back the aggregated values to the individual sample points).

3.1. Definition and assessment of the attributes

The EU assesses the conservation status of a forest habitat type in a BGR by categorizing four criteria in an assessment scheme:

(1) red = unfavourable-bad,

(2) amber = unfavourable-inadequate,

(3) green = favourable,

(4) grey = unknown.[1]

If only one of the criteria is assessed as “unfavourable-bad” (= "red"), the overall conservation status is assessed as “red”, i.e. the respective criterion with the poorest assessment is decisive for the overall assessment.

[1] DocHab-04-03/03 rev.3, Annex E

Table 10: EU criteria and NFI attributes to assess the conservation status of the forest habitat types

Criterion under Doc-Hab (EU Commission 2005, 2011)	Attributes to be surveyed / derived in the scope of the NFI	Assessment
Range	Occurrence of a forest habitat type at the plot (information flows into nationwide grid maps showing the distribution of the forest habitat types)	Trend and comparison with reference values for overall assessment per BGR
Area covered by habitat type within range	Projected forest habitat type area	Trend and comparison with reference values for overall assessment per BGR
Specific structures & functions incl. typical species	Tree species composition Peat moss coverage in bog forest habitat types Deadwood Habitat trees Development phases Layers of forest cover Present threats and pressures	Compilation of the individual assessments to an overall assessment per BGR
Future prospects	Not surveyed in the scope of the NFI	Expert votes by representatives of the nature conservation authorities of the *Länder*.
Overall assessment according to DocHab		*Is carried out by the Federal Government and the Länder in the scope of conferences*

The EU did not stipulate many specific attributes for implementing the content of these criteria during surveillance. Therefore the choice of attributes for NFI forest habitat type surveillance is aligned to the attributes described in the LANA/FCK paper (Burkhardt et al. 2004) (Table 10). This national paper[1] describes nationwide harmonised assessment attributes for assessing the degree of conservation of one *single area* of a forest habitat type. It contains minimum requirements for the assessment of the attributes in a three-stage assessment scale with the grades

(1) A = excellent,

(2) B = good,

(3) C= poor.

The LANA-FCK paper largely lacks suggestions on how the attributes should be surveyed on site (inspection, reference area size, etc.).

[1] Note: The *degree* of conservation of a *single* occurrence in Germany is assessed using categories A, B and C. These are not the same as the EU colour codes for assessing the *status* of conservation at the BGR level in the MS. The *sum* of the assessed single occurrences (*degree* of conservation) is translated into the EU colour codes (*status* of conservation) according to defined rules for each forest habitat type in a BGR.

In this methodology these minimum requirements (thresholds) have been transferred to the sampling method of the NFI while adopting the content of the LANA-FCK specifications as much as possible. However, values will have to be technically adapted because the LANA-FCK paper defines thresholds for occurrence on larger areas of forest habitat types recorded mostly through extensive visual inspections. The corresponding NFI attributes, by contrast, are surveyed at a relatively small sample area of a few hundred square metres at a plot. The compiled evaluation of certain attributes at a number of sample points as a first step enables verified statements for a certain forest habitat type in a BGR.

3.1.1. Old forest cover

The trees in the old forest cover are either classified as main forest cover or residual forest cover. They are surveyed at the plot by means of angle-count sampling 1/2 in accordance with Chapter 5.7.1 of the survey instructions.

Based on the consideration that the M, S and P tree species composition of young forest stages can be of different proportions than climax stages and that non-habitat-typical and/or non-native tree species have great potential for increasing these proportions through great interspecific competitive strength, a similar table is used for the assessment of tree species in forest development phase 1 as for the assessment of the young forest cover (see Chapter 3.1.2).

The assessment of the old forest cover in development phase 1 is made according to the assessment scheme in Table 11. A grade scale is reached if the minimum percentages for M, M+S and M+S+P tree species contained in Table 11 are all achieved.

Table 11: Assessment scheme for the old forest cover in forest development phase 1

	Grade scale	M percentage	M+S percentage	M+S+P percentage	Restriction
	A	≥ 30 %	≥ 40 %	100 %	
	B	≥ 20 %	≥ 30 %	≥ 90 %	in priority forest habitat types
	B	≥ 20 %	≥ 30 %	≥ 80 %	in non-priority forest habitat types
	C	< 20 %	< 30 %	< 80 %	

The assessment of the old forest cover in the development phases 2-5 is made according to Table 12. A grade scale is reached if the minimum percentages for M, M+S and M+S+P tree species contained in Table 12 are all achieved.

Table 12: Assessment scheme for the old forest cover in forest development phases 2-5

	Grade scale	M percentage	M+S percentage	M+S+P percentage	At least 2 main tree species occur (each with min. 10 %)	Restriction
1.	A	≥ 50 %	≥ 70 %	100 %	yes	in 9180
2.	A	≥ 50 %	≥ 70 %	≥ 90 %	yes	in 9160, 9170 and 91F0
3.	A	≥ 50 %	≥ 70 %	100 %	no	in priority forest habitat types with the exception of 9180 and plots in the field allocated to forest habitat types 91D1-4
4.	A	≥ 50 %	≥ 70 %	≥ 90 %	no	in non-priority forest habitat types with the exception of 9160, 9170 and 91F0
5.	B	≥ 40 %	≥ 60 %	≥ 90 %	no	in priority forest habitat types
6.	B	≥ 40 %	≥ 60 %	≥ 80 %	no	in non-priority forest habitat types
7.	C	< 40 %	< 60 %	< 90 %	no	in priority forest habitat types
8.	C	< 40 %	< 60 %	< 80 %	no	in non-priority forest habitat types

The tree species composition of a forest habitat type 91D0 found in the forest must never be assessed with A as the method primarily uses subtypes with a limited main tree species spectrum.

Based on LANA/FCK, stricter values apply to priority forest habitat types.

An additional rule for invasive non-European woods was discussed, but since the uncontrolled occurrence and the planting of these species is assessed under Threats and pressures (see Chapter 3.1.10) this additional rule is not needed here.

The assessment is conducted at the individual sample plot.

3.1.2. Young forest cover

The young forest cover is surveyed in the sample circle with r = 10 m in accordance with Chapter 5.7.1 of the NFI survey instructions. The survey threshold is 1/10 degree of coverage, the plants are between 20 cm and 4 m high. In the scope of the A/B/C assessment of the young forest cover at the individual plot, the tree species' degree of coverage is not determined on the entire sample plot area. Instead, the area covered by the above-ground parts of the trees is set as 100 %. The A/B/C area distribution in a region is determined without this reduction in accordance with the NFI extrapolation rules.

The potential of an increased percentage of non-habitat-typical and/or non-native tree species through their sometimes great interspecific competitive strength is specifically taken into ac-

count and the assessment scale is set more specifically in regeneration. By contrast, for habitat-typical tree species composition (often shade- or semi-shade-demanding tree species) we can anticipate an increase in the main tree species with age so that the thresholds are set lower here.

The percentages of the tree species of young forest cover are assessed. The assessment of the young forest cover is made according to Table 13. A grade scale is reached if the minimum percentages for M, M+S and M+S+P tree species contained in Table 13 are all achieved.

Table 13: Assessment scheme for the young forest cover.

Grade scale	M percentage	M+S percentage	M+S+P percentage
A	≥ 30 %	≥ 40 %	100 %
B	≥ 20 %	≥ 30 %	≥ 90 %
C	< 20 %	< 30 %	< 90 %

The existence or extent of young forest cover (i.e. the area percentage of the regenerated area) is not assessed since it depends on various factors about which only limited information is available.

The assessment is conducted at the individual sample plot.

3.1.3. Main forest cover

If both old and young forest cover occur, the main forest cover is additionally assessed. The main forest cover is the layer where the economic focus lies. If the coverage of trees over 4 metres in height amounts to at least 5/10, this is always the main forest cover.

The following A/B/C assessment scheme applies to the main forest cover:

- If the young forest cover is the main forest cover, the A/B/C assessment scheme of the young forest cover (see Chapter 3.1.2) is used.
- If the old forest cover is the main forest cover, the A/B/C assessment scheme of the old forest cover (see Chapter 3.1.1) is used. A distinction is to be made between the different development phases. Trees of the residual forest cover (hold-over trees) and the trees taken into account in the r = 10 m circle are not part of the main forest cover.

The assessment is conducted at the individual sample plot.

3.1.4. Peat moss coverage

For bog woodland forest habitat types 91Dx (survey unit: area of forest cover), the area percentage of *Sphagnum* spp. is assessed as an indicator of the "intactness" of typical moor hydrology (Table 14).

Table 14: Assessment of the peat moss coverage

	A	B	C
Peat moss coverage	> 30 %	≤ 30 % and > 20 %	≤ 20 % and ≥ 5 %

The assessment is conducted at the individual sample plot.

3.1.5. Ground vegetation

Indicator species of the ground vegetation are required for the designation and the verification of the designation of certain forest habitat types (see Chapter 2.3). They are, however, not taken into account for assessment with the method chosen here.

3.1.6. Deadwood

Deadwood is a very important forest ecology assessment attribute. The large numbers of xylobiotic animal, fungus and lichen species alone prove the huge significance of this attribute for species diversity in forests. Deadwood was already surveyed during NFI 2002 with a survey threshold of 20 cm in a sample circle with a 5 m radius.

Since deadwood occurs with inhomogeneous distributions (clumped) in small areas and is subjected to chronological dynamics, the reference area is very significant for the issue of assessment. The survey area in a circle with r = 5 m is so small that it is unsuitable for a direct assessment of the deadwood stock at the individual sample plot. The attribute is therefore not assessed at the individual sample plot but at the level of the biogeographic regions or the physiographic large-scale regions following the aggregation of all relevant sample plots (see Chapter 3.2.3). An enlargement of the survey area is out of the question for reasons of costs.

Deadwood of habitat type-typical tree species is not differentiated separately.

The thresholds are derived from the LANA-FCK paper, whereby the following applies to the assessment of large deadwood (> 50 cm):

- B: > 1 object/ha,
- A: > 3 objects/ha (lying and standing).

The LANA-FCK expressly allows the use of cubic meters of solid timber.

Distinctly lower thresholds must be set for bog woodlands and softwood riparian forests. Bog woodlands in particular are naturally very low in timber stock (with the exception of mire spruce woods) and chiefly also low in deadwood to be surveyed (survey threshold 20 cm).

The thresholds listed in Table 15 apply to the forest habitat types:

Table 15: Assessment scheme for deadwood

Forest habitat type group	B [m³/ha]	A [m³/ha]
Beech forest habitat types	≥ 15 and < 35	≥ 35
Oak forest habitat types	≥ 15 and < 35	≥ 35
Ravine forest	≥ 15 and < 35	≥ 35
Acidophilous coniferous forest, mire spruce woods	≥ 15 and < 35	≥ 35
Hardwood riparian forest	≥ 15 and < 35	≥ 35
Softwood riparian forest	Expert assessment: ≥ 10 and < 20	Expert assessment: ≥ 20
Bog forest habitat types apart from mire spruce woods	Expert assessment: ≥ 5 and < 10	Expert assessment: ≥ 10

The thresholds are based on the deadwood definition of NFI 2002 (particularly the survey threshold of 20 cm). This must be taken into due account during the evaluation of the NFI 2012 data on the deadwood stock.

3.1.7. Habitat trees

Living trees with special biotope functions are designated as habitat trees. A definition of the attribute can be found in Appendix 7.

In accordance with Chapter 5.5 of the survey instructions, the survey unit is angle-count sampling 4, for which each tree must be considered precisely for the recording of a number of attributes and during which trees with cavities were already surveyed by NFI 2002.

This is a non-homogeneously distributed attribute that is spatially very distinctive. The definition and selection method chosen here do not allow for assessment at the individual sample plot. The assessment is conducted at the level of the biogeographic regions or the physiographic large-scale regions (see Chapter 3.2.3).

A survey in a circle with r = 25 m was discarded due to excessive survey expense and limited detection probability.

Proposed assessment based on LANA-FCK:

- A: ≥ 6 objects/ha
- B: ≥ 3 objects/ha and < 6 objects/ha,
- C: < 3 objects/ha.

Multiple attributions with regard to the attributes in Appendix 7 are possible (i.e. for example woodpecker cavity + eyrie tree + fungi fruiting body in *one* tree).

3.1.8. Development phases

The development phases are defined as follows:

Table 16: Development phases

Development phase	Name	DBH
Development phase 1	Temporarily unstocked area to pole-sized stands	< 20 cm
Development phase 2	Marginal timber stand	≥ 20 cm to < 35 cm
Development phase 3	Medium timber stand	≥ 35 cm to < 50 cm
Development phase 4	Strong timber stand	≥ 50 cm to < 70 cm
Development phase 5	Very strong timber stand	≥ 70 cm

Survey procedure:

Only one development phase can be designated at the sample plot of a survey unit; this is the phase of the main forest cover. The information refers to the predominant phase in the main forest cover related to the basal area (for definition see Chapter 3.1.3).

Assessment procedure:

The attribute cannot be assessed at the sample plot of a survey unit since the small assessment area only allows for the designation of one phase. The assessment is therefore conducted at the level of the biogeographic regions or the physiographic large-scale regions (see Chapter 3.2.1).

The frequency distribution of the development phases occurring in a forest habitat type is assessed. The assessment of the development phases is made according to Table 17.

Table 17: Assessment scheme for the development phases

A	B	C
Stages with following % found (AND operation):		
Development phase 1: ≥ 5 %	Development phase 1: ≥ 5 %	All other combinations
Development phase 2: ≥ 5 %	Development phase 2: ≥ 5 %	
Development phase 3: ≥ 10 %	Development phase 3: ≥ 10 %	
Development phases 4 + 5: ≥ 40 %	Development phases 4 + 5: ≥ 17 % and < 40 %	

Slow growing forest habitat types (91Dx, 91E0) cannot be assessed as their development phases can be demonstrated by the DBH only to a limited extent.

3.1.9. Layers / Structure of the forest cover

To survey the vertical structure of the forest cover we use the definition of NFI 2012, which is based on a "common canopy" of a layer. Up to three layers are differentiated (> 2 layers: multiple layers).

The assessment of the layers is conducted for an individual sample plot as set out in Table 18.

Table 18: Assessment scheme for the layers / structure of the forest cover

		A	B	C
(1)	All forest habitat types except 91Dx	≥ 3 layers	2 layers	1 layer
(2)	91Dx	≥ 2 layers	1 layer	no layer present

3.1.10. Threats and pressures

The EU code list is too extensive and in many points too vague and therefore not suitable for the NFI 2012. Many of the threats and pressures cited there, such as "forestry use" should only be considered threats and pressures in very specific cases. Others are ambivalent in their area effect or exact definition and difficult to designate or assess at the sample plot of a survey unit.

Classifying the threats and pressures in the DocHab scheme

According to the status of discussions with the BfN and the *Länder* nature conservation authorities ("PAN/ILÖK paper") the following will be included under "Future prospects":

- present threats and pressures (see Appendix 8),
- assessments of threat to the habitat type according to the Red List,
- expert assessment of the development prospects ("long-term viability" of the habitat type).

The following present threats and pressures are surveyed during the NFI and assessed under the A/B/C scheme (see Appendix 8):

- invasive woody plants,
- invasive herbaceous species,
- eutrophication indicators,
- driving tracks.

Not all present threats and pressures can, however, be surveyed or assessed in the scope of the NFI. Further attributes can be drawn upon (via expertise) in the FFH assessment conferences concerning additional data sources (e.g. LEVEL I and II forest damage inventories for new types of forest damages, statistics from completed forest protection measures for impairments caused by pests, data from the nature conservation administrations). The working group notes that in the case of possible increasing synchronisation of the survey networks (NFI-WZE-BZE-VGA, etc.) such sources in future could possibly also be directly linked to the FFH assessment.

3.2. Aggregation method

3.2.1. Aggregation method for FFH surveillance

The *Länder* methods for the assessment of the specific structures and functions of the habitat types in the scope of **FFH surveillance** are chiefly based on area inspections of sufficiently large single occurrences. The EU parameter "specific structures and functions" is subdivided into the three criteria

- "Completeness of the habitat-typical habitat structures"
- "Completeness of the habitat-typical species inventory"
- "Treats and pressures"

For each of these criteria, one or several attributes are surveyed in the field and assessed individually by way of allocating one of three ordinal scale grades (A = extraordinary conservation status, B = good conservation status, C = medium to bad conservation status). The assessments of the single attributes are then aggregated to an overall assessment of the EU parameter "specific structures and functions" for each individual sample plot with the help of a calculation matrix. Ultimately, the percentages of the sample plots in the three scale grades A, B and C are determined for this parameter. With a view to translating the assessment of the degree of conservation at the level of the single occurrences (scale grades A, B and C) into an assessment of the conservation status at the level of a biogeographic region (EU colour code: "green" = favourable conservation status, "amber = unfavourable-inadequate conservation status, "red" = unfavourable-bad conservation status), only the percentage of surveyed occurrences (obtained from a "63 samples" system or from a total census) in scale grade C was taken into account for the national report 2013. The thresholds listed in Table 19 were applied which, however, did not refer to the **area** percentage but to the percentage of the **number** of surveyed occurrences (irrespective of the area size) in scale grade C.

3.2.2. Aggregation method for the NFI

In the NFI 2012, the aggregation method applied to convert the assessments of the individual parameters of an FFH forest habitat type into the EU colour code for the assessment of the parameter "specific structures and functions" (see Appendix to agenda item 4.2 in LANA 2006 and Annex E in EU Commission 2011) was based on the method used for the habitat types within the scope of FFH surveillance and took place in four steps (see Figure 2):

(a) The A/B/C assessments of the single attributes were aggregated at each plot to A/B/C assessments of the three attribute groups "species inventory", "habitat structures" and "threats and pressures". These attribute groups correspond to the EU criteria "completeness of the habitat-typical species inventory", "completeness of the habitat-typical habitat structures" and "threats and pressures".

(b) The A/B/C assessments of the three attribute groups were aggregated at each plot to A/B/C assessments of the EU parameter "specific structures and functions".

(c) The areas of the forest habitat types in the biogeographic regions were determined by extrapolation and classified according to the A/B/C assessments of the "specific structures and functions".

(d) For each forest habitat type in each biogeographic region where this forest habitat type occurs, the A/B/C assessments of the specific structures and functions were translated into the EU colour code by way of comparing the extrapolated C area percentage with the thresholds listed in the following conversion scheme (Table 19).

Table 19: Scheme for the conversion of the national C area percentage of a forest habitat type in a BGR into an assessment according to the EU colour code

C area percentage		Assessment according to the EU colour code
> 25 %	=	unfavourable-bad (U2 / colour code "red")
> 20 % and ≤ 25 % (intermediate stage)	=	unfavourable-inadequate (U1 / colour code "amber")
≤ 20 %	=	favourable (FV / colour code "green")

3.2.3. Assessment of inhomogeneously distributed (clustered) attributes

Due to the low area size of the NFI survey units at the plots, only the parameters "tree species composition", "peat moss coverage", "layers / structure of the forest cover" and "threats and pressures" can be directly assessed with A/B/C at each plot.

Attributes that occur in very inhomogeneous distributions (clustered) – such as habitat trees, deadwood and distribution measurements such as development phases – cannot be covered by an assessment at the individual survey units (= plots) of the NFI with the method described here. These attributes are almost always assessed as A or C (if the attribute occurs it is assessed per hectare as A, or if the attribute does not occur it is assessed as C). Due to this levelling, the results cannot be differentiated in the further course of the evaluation.

The option to enlarge the survey units (sample circle radii) cannot apply as

- this would result in disproportionately high costs,
- the method would reach its technical limits, and
- the congruence with the sample circle on which other forest habitat type attributes were designated would no longer be assured.

At best, in such cases it would be possible to combine the values recorded at many individual sample plots for the assessment. Aggregation at the forest biogeoclimatic zone level is not expedient since the forest biogeoclimatic zones are frequently too small for statistical evaluations and contain very different numbers of plots for the different forest habitat types. The aggregation is conducted at the level of the biogeographic region.

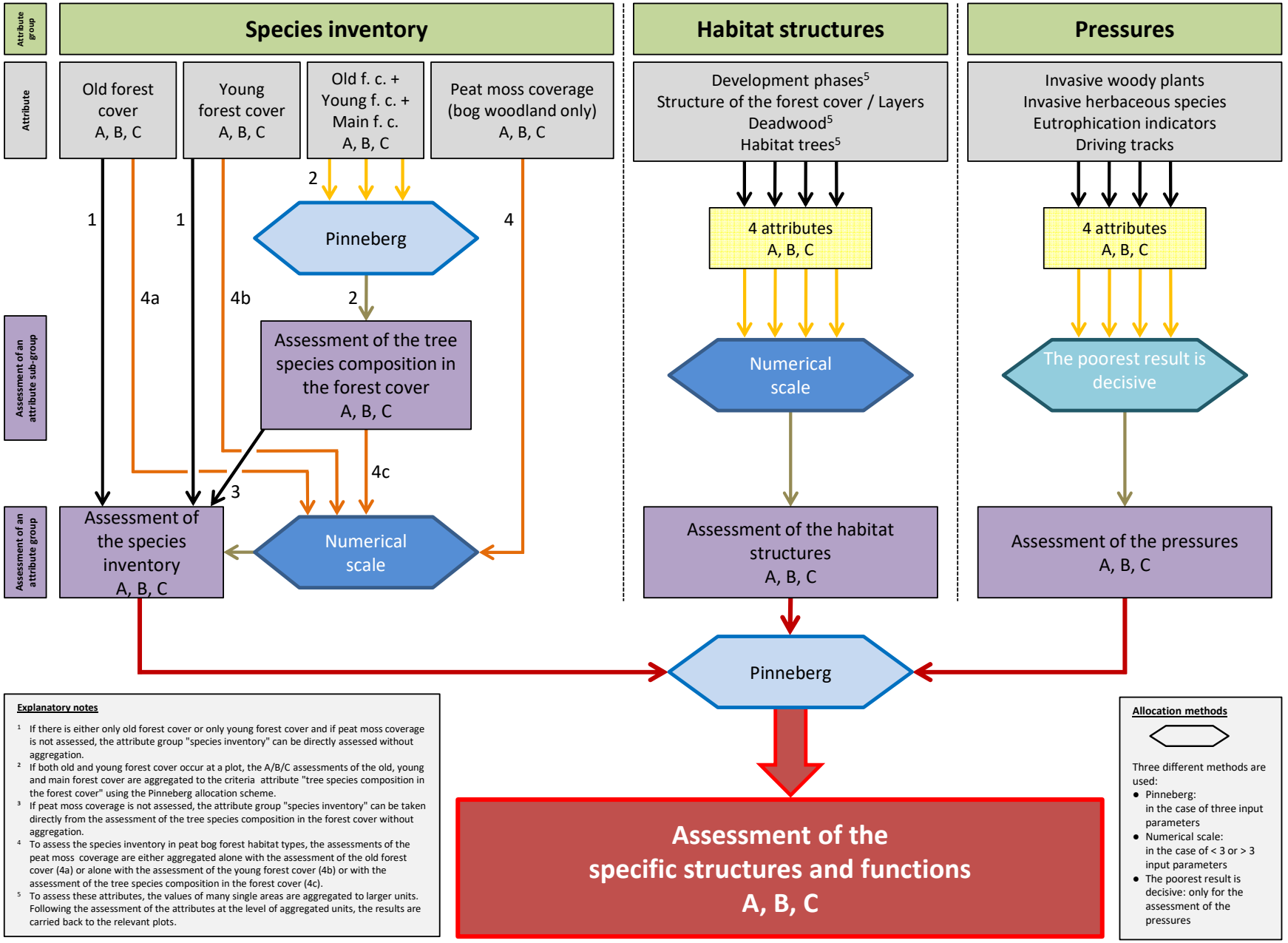
Following the assessment of the attributes at the level of aggregated units, the results are carried back to the relevant plots.

3.2.4. Assessment of the specific structures and functions per forest habitat type and biogeographic region

For the assessment of a forest habitat type at the BGR level in accordance with the DocHab it is necessary to ascertain a distribution of the grades A, B and C over the single occurrences (plots). In the scope of the NFI, the assessment of the single attributes at the plots is first aggregated to assess the specific structures and functions of the forest habitat type at each plot (degree of conservation). The specific structures and functions over all occurrences of a forest habitat type in a BGR and the area-related distribution of the scale grades in the BGR are calculated with the help of NFI extrapolation algorithms.

The specific structures and functions of a forest habit type at a plot are assessed in several successive aggregation steps (Figure 2).

Figure 2: Overview of the assessment of the specific structures and functions at a forest habitat type plot through successive aggregation of the attribute assessments. Used abbreviations are Old f. c. = old forest cover, Young f. c. = young forest cover, Main f. c. = main forest cover



If there is either only old forest cover or only young forest cover and if peat moss coverage is not assessed, the attribute group "species inventory" can be directly assessed without aggregation. But if, on the other hand, both old and young forest cover occur at a plot, the separate A/B/C assessments of the old, young and main forest cover available for each plot are first aggregated at equal weighting to the attribute sub-group "tree species composition in the forest cover" using the Pinneberg allocation scheme (Table 20).

Table 20: Determination of the A/B/C assessment of the tree species composition in the forest cover from the assessment results for the old, young and main forest cover

Attribute	Case groups												
Old forest cover	A	A	A	A	B	B	B	B	B	C	C	C	C
Young forest cover	A	B	B	C	A	A	B	C	C	A	B	B	C
Main forest cover	A	A	B	A	A	B	B	B	C	C	B	C	C
Tree species composition in the forest cover	A	A	B	B	A	B	B	B	C	C	B	C	C

In non-peat bog forest habitat types, the assessment of the species inventory is equal to the assessment of the tree species composition in the forest cover. In peat bog forest habitat types, the assessments of the peat moss coverage and the tree species composition in the forest cover are aggregated at equal weighting to assess the species inventory.

The assessments of the attributes "development phases", "layers", "deadwood" and "habitat trees" are aggregated at equal weighting to the attribute group "habitat structures" In the same way, the assessments of the attributes "invasive woody plants", "invasive herbaceous species", "eutrophication indicators", "driving tracks off of regular pathways" and "detail forestry accessibility lines" are aggregated to the attribute group "threats and pressures" with the poorest individual assessment being decisive for the result. "A" can only be given if *all* relevant threats and pressures were assessed as "A" (distinction of the A/B/C assessments of the threats and pressures: see Appendix 8: Threats and pressures).

In a final step, the assessment results for the attribute groups "species inventory", "habitat structures" and "threats and pressures" are aggregated at equal weighting using the Pinneberg scheme to obtain the assessment result for the parameter "specific structures and functions" of a forest habitat type at a plot. This is then used to determine the area percentage with "C" assessment for the individual forest habitat types in the three BGRs with the help of NFI extrapolation algorithms.

3.2.5. Allocation methods

Three different allocation methods are used for the aggregation of the assessment results:

(1) allocation according to the Pinneberg scheme,

(2) allocation of the threats and pressures and

(3) allocation with the help of a numeric scale.

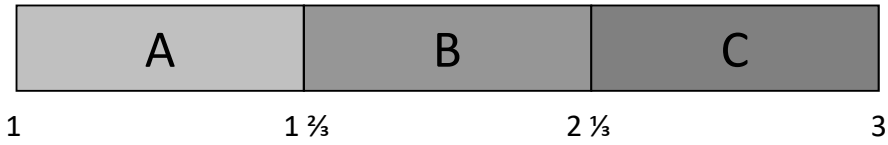
re 1) Allocation according to the Pinneberg scheme aggregates the values of three input parameters to one single value. This scheme (see Table 21) is applied to generate the scale grade of the attribute group "tree species composition in the forest cover" if both old and young forest cover occur and to determine the specific structures and functions from the three attribute groups.

Table 21: Determination of the scale grade of the specific structures and functions from the assessment results of the attribute groups "species inventory", "habitat structures" and "Threats and pressures" and in other cases in which the values of three input parameters are aggregated to one single value.

Attribute group	Case groups																										
Species inventory	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	C	C	C	C	C	C	C	C	C
Habitat structures	A	A	A	B	B	B	C	C	C	A	A	A	B	B	B	C	C	C	A	A	A	B	B	B	C	C	C
Threats and pressures	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Specific structures and functions	**A**	**A**	**B**	**A**	**B**	**B**	**B**	**B**	**C**	**A**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**B**	**B**	**C**	**B**	**B**	**C**	**C**	**C**	**C**

re 2) As described in Chapter 3.2.4, when allocating the threats and pressures, the attribute with the poorest assessment result of the attribute group "threats and pressures" determines the scale grade of the entire attribute group.

re 3) Allocation with the help of a numeric scale is always used for aggregation purposes if more or fewer than three different attributes must be aggregated. The ordinal scale grades A, B and C are first converted into the numerical values 1, 2 and 3 (A → 1, B → 2, C → 3) before the arithmetic mean is calculated. A mean value > 2 ⅓ is “C”, a mean value > 1 ⅔ and ≤ 2 ⅓is “B”, a mean value ≤ 1 ⅔ is “A”.



Appendix 9 contains a fictitious example to illustrate the aggregation of the assessment results.

3.2.6. Preparation of the national FFH report on forest habitat types

To assess the forest habitat types occurring in the national FFH report of 2013, the BfN used the results of the NFI assessment procedure for the parameter "specific structures and functions". According to EU requirements (BMU 2011), the results for the parameter "specific structures and functions" were combined with the results of the assessment of "range", "area covered" and "future prospects" in order to assess the conservation status of the forest habitat types in the BGRs (see Table 10). The information necessary for this was provided by the specialised *Länder* authorities in charge of nature conservation (e.g. from nature conservation monitoring programmes). This sometimes also includes additional information on the specific structures and functions of the relevant forest habitat types. All information relevant to the assessment of the forest habitat types was examined by the BfN. The derived assessments of all habitat types were agreed between the Federal Government and the *Länder* at several assessment conferences. The assessments of the forest habitat types were agreed with the *Länder* during a separate assessment conference of the Federal Ministry for the Environment (BMUB) on 28/29 July 2013. Expert votes were of great importance in this respect. The assessment of the parameter "specific structures and functions" in the national FFH report 2013 differs from the results obtained in the NFI procedure if this was decided by expert vote during the assessment conference.

Abbreviations

BB	Brandenburg
BfN	Bundesamt für Naturschutz / Federal Agency for Nature Conservation
BGR	Biogeographic region
BW	Baden-Württemberg
BY	Bavaria
BZE	Bodenzustandserhebung / Forest Soil Survey
COM	EU Commission
DocHab	Assessment, monitoring and reporting of conservation status – Preparing the 2001-2007 report under Article 17 of the Habitats Directive (see EU Commission 2005, 2011)
EU	European Union
FCK	Forstchefkonferenz / Forest Directors' Conference
FFH	Fauna-Flora-Habitat-Richtlinie / Habitats Directive
FHT	Forest habitat type
HB	Habitatbäume / Habitat trees
HE	Hesse
LANA	Bund-/Länderarbeitsgemeinschaft Naturschutz / Federal Government/*Länder* Working Group on Nature Conservation
LRT	Lebensraumtyp / Habitat type (in accordance with Annex I of the Habitats Directive)
M	Main tree species
MS	Member States
MV	Mecklenburg-Western Pomerania
Nat. FC	Natural forest community
NFI	National Forest Inventory
NI	Lower Saxony
NW	North Rhine-Westphalia

P	Pioneer tree species (in the context of tree species lists)
RP	Rhineland-Palatinate
S	Secondary tree species
SH	Schleswig-Holstein
SL	Saarland
SN	Saxony
ST	Saxony-Anhalt
TI-WO	Thünen-Institut für Waldökosysteme / Thünen Institute of Forest Ecosystems
TH	Thuringia
VGA	Verjüngungsgutachten (Verbissgutachten) / Survey (of browsing damage) in regeneration stands
WLRT	Wald-Lebensraumtyp / Forest habitat type
WZE	Waldzustandserhebung / Crown Condition Assessment

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Appendices

1. **Map of the biogeographic regions (BGR) and physiographic the large-scale regions**

2. **List of the current natural NFI forest communities**

3. **Table allocating natural forest communities to forest habitat types**

4. **List of species and attributes differentiating the forest habitat types 9160, 9170 and 9190**

5. **Regionalised database of tree species of the forest habitat types by M, S, P**

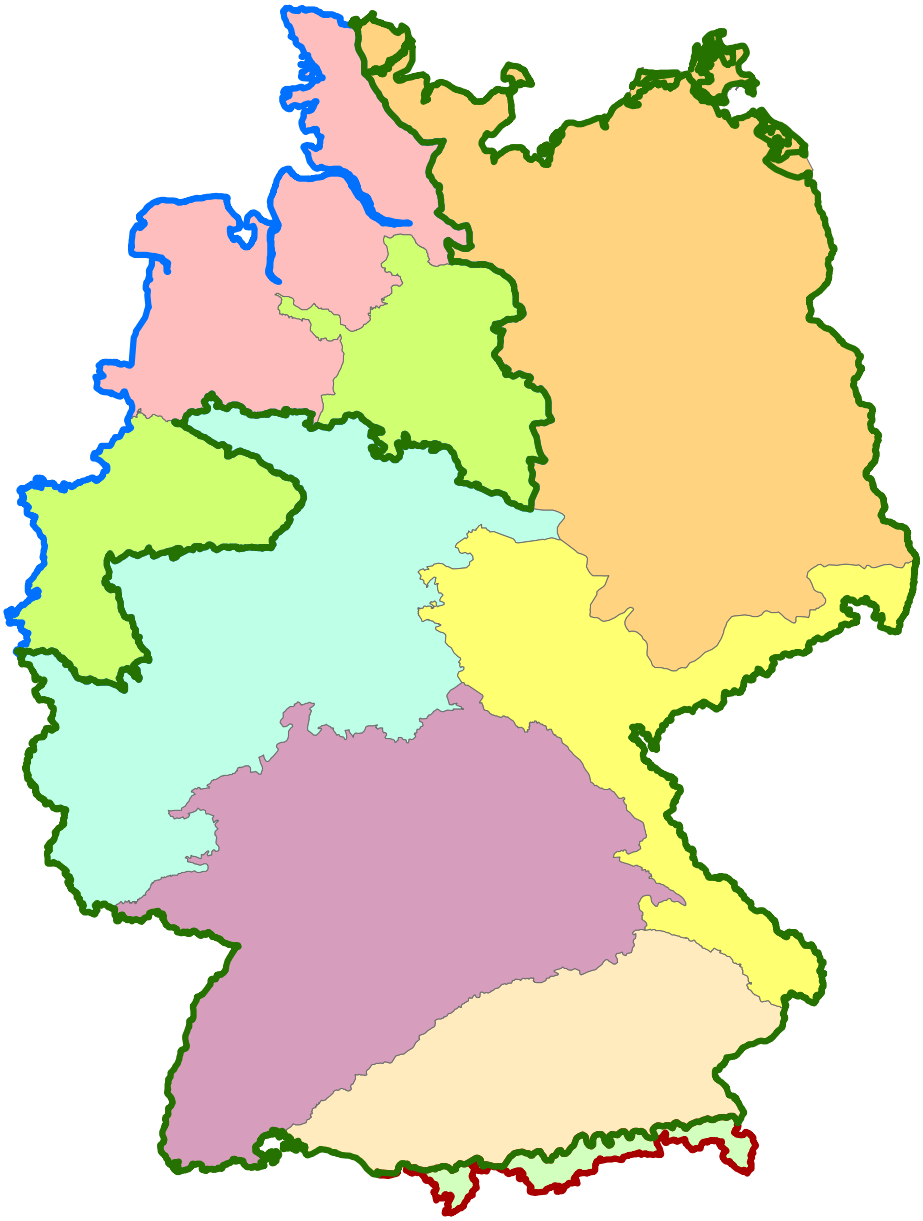
6. **Forest habitat type algorithm: Flow chart**

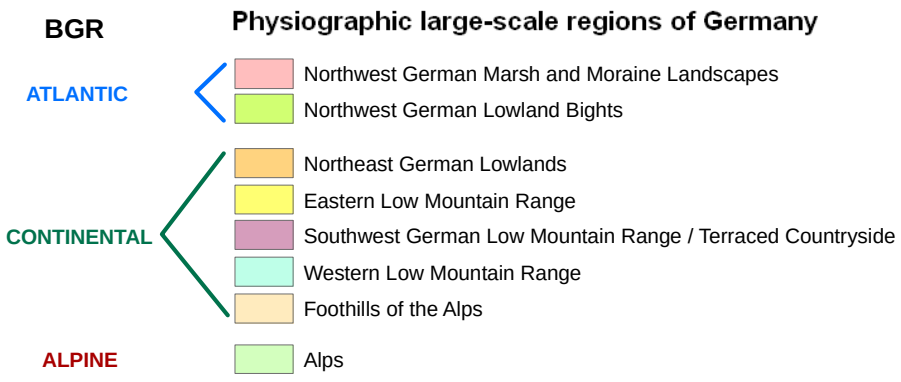
7. **Habitat tree definition**

8. **Threats and pressures**

9. **Example of aggregation and attribute allocation**

Appendix 1: Map of the biogeographic regions (BGR) and the physiographic large-scale regions





Source: German Federal Agency for Nature Conservation (BfN), Geobasic Data (c) GeoBasis-DE / BKG.

Appendix 2: List of the current natural NFI forest communities

1	Luzulo-Fagetum beech forests, sometimes with firs	Luzulo-Fagetum
2	Wavy hair grass-beech forest	Deschampsio-Fagetum
3	Woodruff- beech forests, sometimes with firs	Galio odorati-Fagetum
4	Wild rye-beech forests, sometimes with firs	Hordelymo-Fagetum
5	Beech-durmast oak forest	Fago-Quercetum
6	Alpine honeysuckle-fir-beech forest	Lonicero alpigenae-Fagetum
7	Sedge-beech forest	Carici-Fagetum
8	Spruce-beech forest	Fago-Piceetum
9	Sycamore maple-beech forest	Aceri-Fagetum
10	Wood rush-spruce-fir forest	Luzulo-Abietetum
11	Bedstraw-spruce-fir forest	Galio rotundifolii-Abietetum
12	Cranberry-spruce-fir forest	Vaccinio-Abietetum
13	Wintergreen-spruce-fir forest	Pyrolo-Abietetum
14	Birch-common oak forest	Betulo-Quercetum roboris
15	Birch-durmast oak forest	Luzulo-Quercetum
16	Cranberry-oak forest and Leucobryum moss-pine forest	Vaccinio vitis-idaeae-Quercetum and Leucobryo-Pinetum
17	Stitchwort-hornbeam-common oak forest	Stellario holosteae-Carpinetum
18	Wood bedstraw-hornbeam-durmast oak forest	Galio sylvatici-Carpinetum
19	Durmast oak-lime forests	Querco-Tilietum
20	Xerothermic oak-mixed forests	Quercion pubescenti-petraeae, Carpinion p.p.
21	Winter heath-pine forests	Erico-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
25	Green alder grove	Alnetum viridis
26	Carpathian birch-rowan-boulder forest	Betulo carpaticae-Sorbetum
27	Boulder spruce forest	Asplenio-Piceetum
28	Bazzania moss-spruce forest	Bazzanio-Piceetum
29	Small reed-spruce forest	Calamagrostio villosae-Piceetum
30	Alpine coltsfoot-spruce forest	Homogyno-Piceetum
31	Alpenrose-dwarf pine groves	Erico-Pinion p.p., Rhododendro-Vaccinienion p.p.
32	Larch-Swiss stone pine forest	Vaccinio-Pinetum cembrae
33	Bog bilberry-moorland forests	Piceo-Vaccinienion

34	Black alder alluvial forests	Alnion glutinosae
35	Bird cherry-alder-ash alluvial forests	Pruno-Fraxinetum
36	Ash brook forests	Carici remotae-Fraxinetum
37	Ash-alder forest of fast flowing rivers	Stellario-Alnetum
38	Grey alder forest of fast flowing rivers	Alnetum incanae
39	Oak-elm floodplain forest	Querco-Ulmetum
40	Lowland alluvial willow forest	Salicetum albae
161	Cranberry-oak forest	Vaccinio vitis-idaeae-Quercetum
162	Leucobryum moss-pine forest	Leucobryo-Pinetum

Appendix 3: Table allocating natural forest communities to forest habitat types

Natural forest community	Forest habitat type														
	2180	9110	9130	9140	9150	9160	9170	9180	9190	91D0	91E0	91F0	91G0	9410	9420
1	1	1							2						
2	1	1							2						
3	1		1				2								
4	1		1			2	2								
5	1	1				2	2		3						
6			1			2	2								
7					1		2								
8		1													
9				1											
10														1	
11			1												
12														1	
13			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

Codes of the natural forest communities from 1 to 40: see Appendix 2: List of the current natural NFI forest communities

Appendix 4: Lists of species and attributes differentiating the forest habitat types 9160, 9170 and 9190

Taken from Chapter 5.7.5.3, p. 61 ff. of the survey instructions for the NFI 2012.

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 types 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.

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
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

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

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

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
9170 at least one individual present (NW)	*Convallaria majalis*	Lily-of-the-valley
	Galium sylvaticum	Wood bedstraw

Acidophilous oak woods (forest habitat type 9190)

Taken from Chapter 5.7.5.4, p. 64, of the survey instructions for the NFI 2012.

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 (*Molinia caerulea*) 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 sound basis	No attribute present	At least one attribute present
Carpinion type	Not present	Present

Appendix 5: Regionalised database of tree species of the forest habitat types by M, S, P

The regionalised database of tree species of the forest habitat types by M, S, P is contained in the Access table "b3_def_banwg" in the zip file that can be accessed at

https://bwi.info/Download/de/BWI-Basisdaten/ACCESS2003/bwi20150320_alle_daten2012.zip

In this table, column name H stands for main tree species and column name N for secondary tree species.

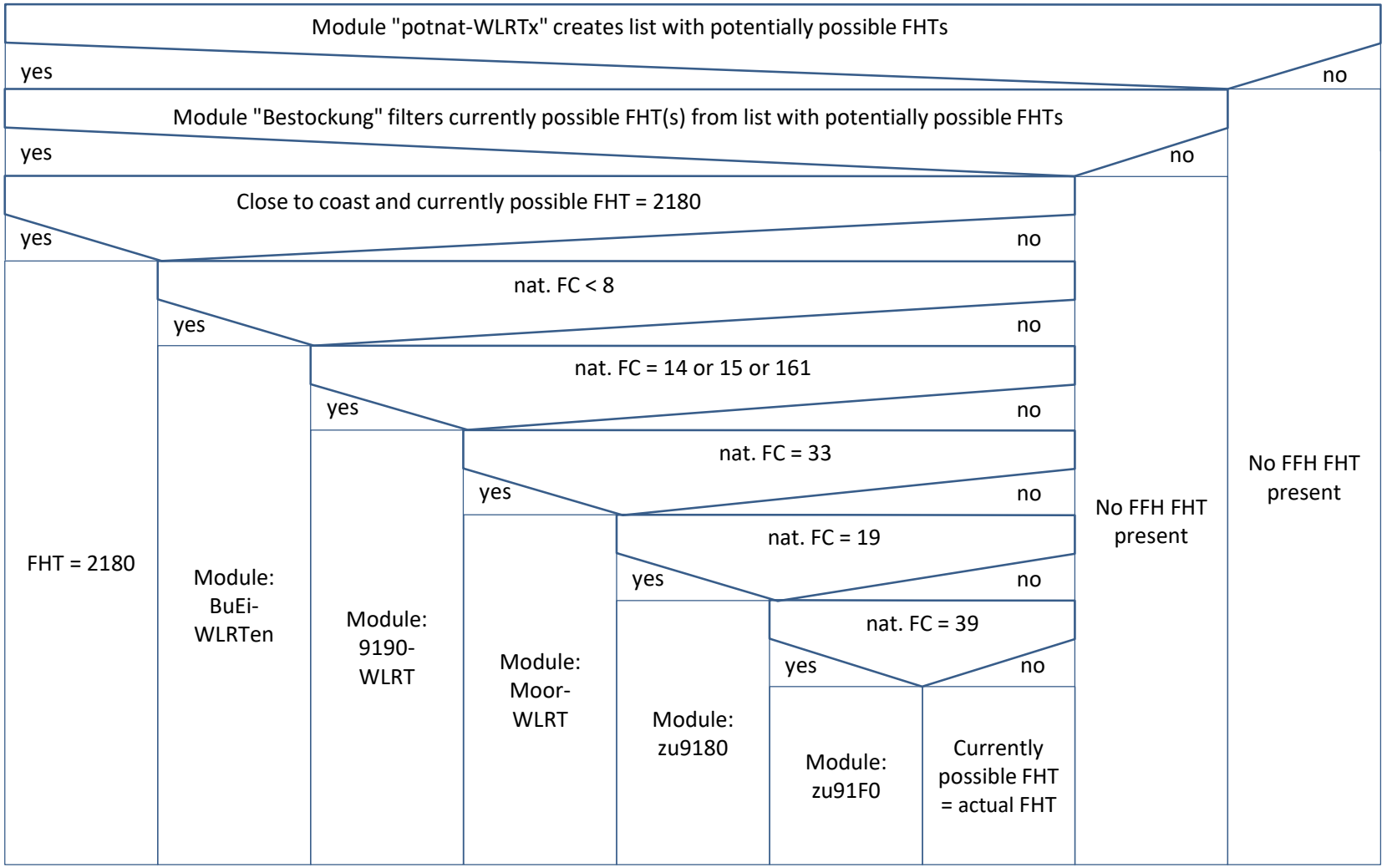
Appendix 6: Forest habitat types algorithm: Flow chart

The basic flow chart (next page) can be used to check at each forest plot whether a forest habitat type actually occurs or not.

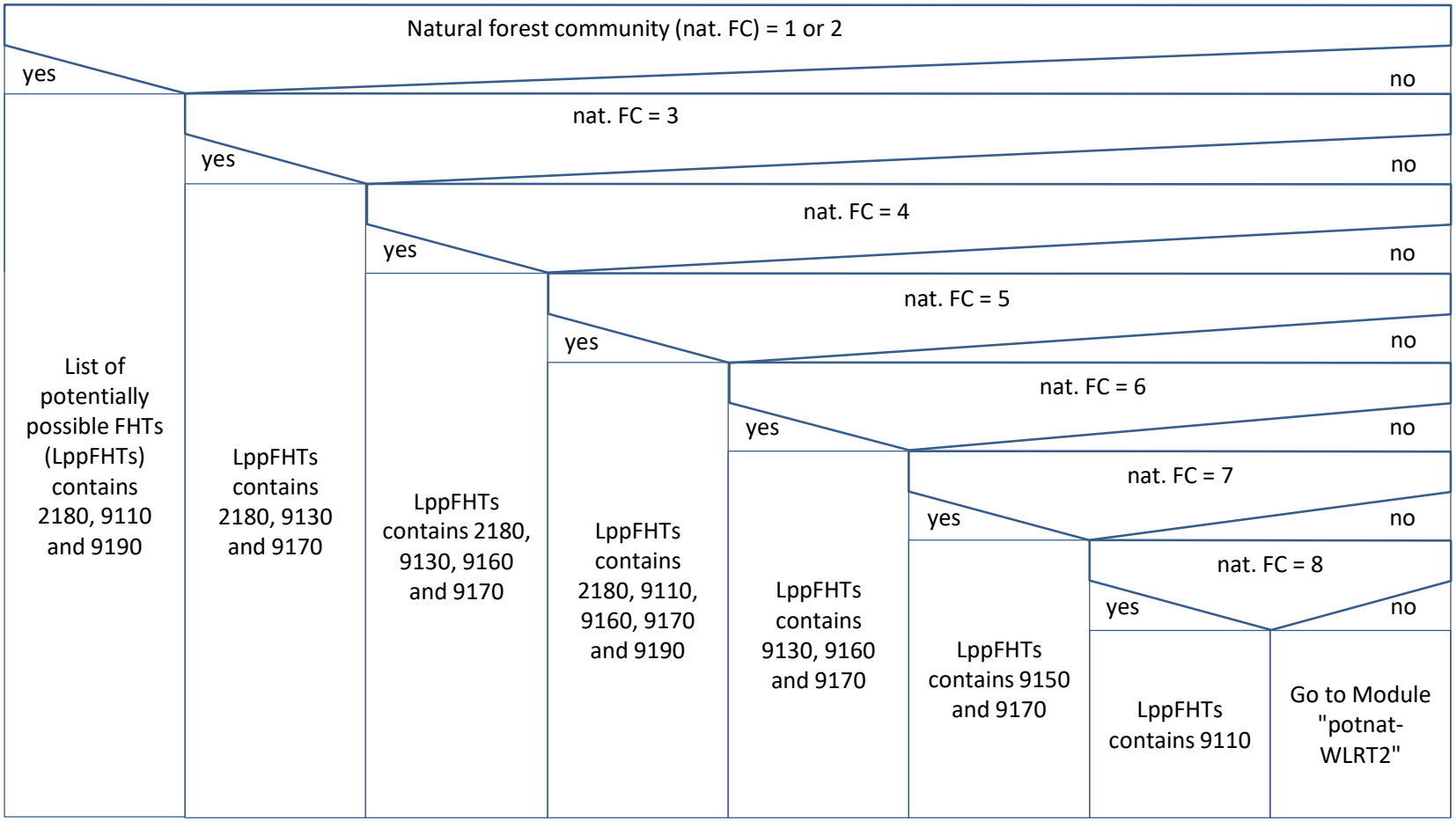
Abbreviations used:

AntBu: Sum of the percentages of beech trees in the total number of trees
AntEi: Sum of the percentages of oak trees in the total number of trees
AntFi: Sum of the percentages of spruce trees in the total number of trees
AntH: Sum of the percentages of the main tree species in the total number of trees
AntHN: Sum of the percentages of the main and secondary tree species in the total number of trees
AntHNP: Sum of the percentages of the main, secondary and pioneer tree species in the total number of trees
AntKi: Sum of the percentages of pine trees in the total number of trees
AntLb: Sum of the percentages of deciduous trees in the total number of trees
AntMb: Sum of the percentages of white birch trees in the total number of trees
AntN: Sum of the percentages of secondary tree species in the total number of trees
AntNb: Sum of the percentages of coniferous trees in the total number of trees
AntP: Sum of the percentages of pioneer tree species in the total number of trees
FHT: Forest habitat type
HB: Hanseatic City of Bremen
HH: Hanseatic City of Hamburg
FFH: (Flora-Fauna-) Habitats Directive
Nat. FC: Current natural forest community (for codes of the natural forest communities from 1 to 40 see Appendix 2)
NFI: National Forest Inventory
MinH: Minimum percentage of the main tree species in the total number of trees
MinHN: Minimum percentage of the main and secondary tree species in the total number of trees
MinHNP: Minimum percentage of the main, secondary and pioneer tree species in the total number of trees
MV: Mecklenburg-Western Pomerania
NI: Lower Saxony
SH: Schleswig-Holstein
WLRT: Forest habitat type (for codes see Table 3)
WZP1/2: Angle-count sampling with basal area factor 1 or 2
WZP4: Angle-count sampling with basal area factor 4

Basic flow chart



Module: "potnat-WLRT1"



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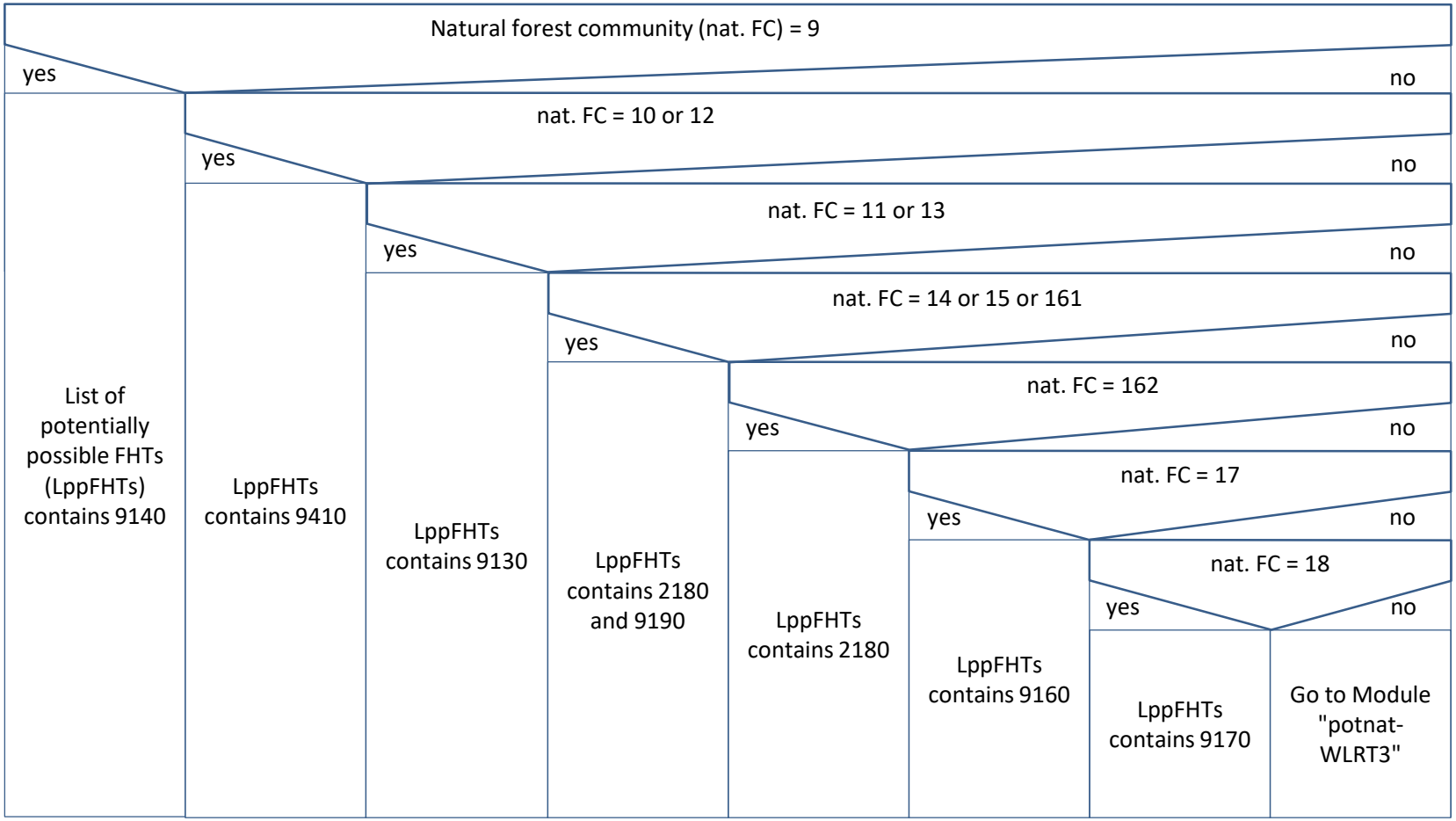
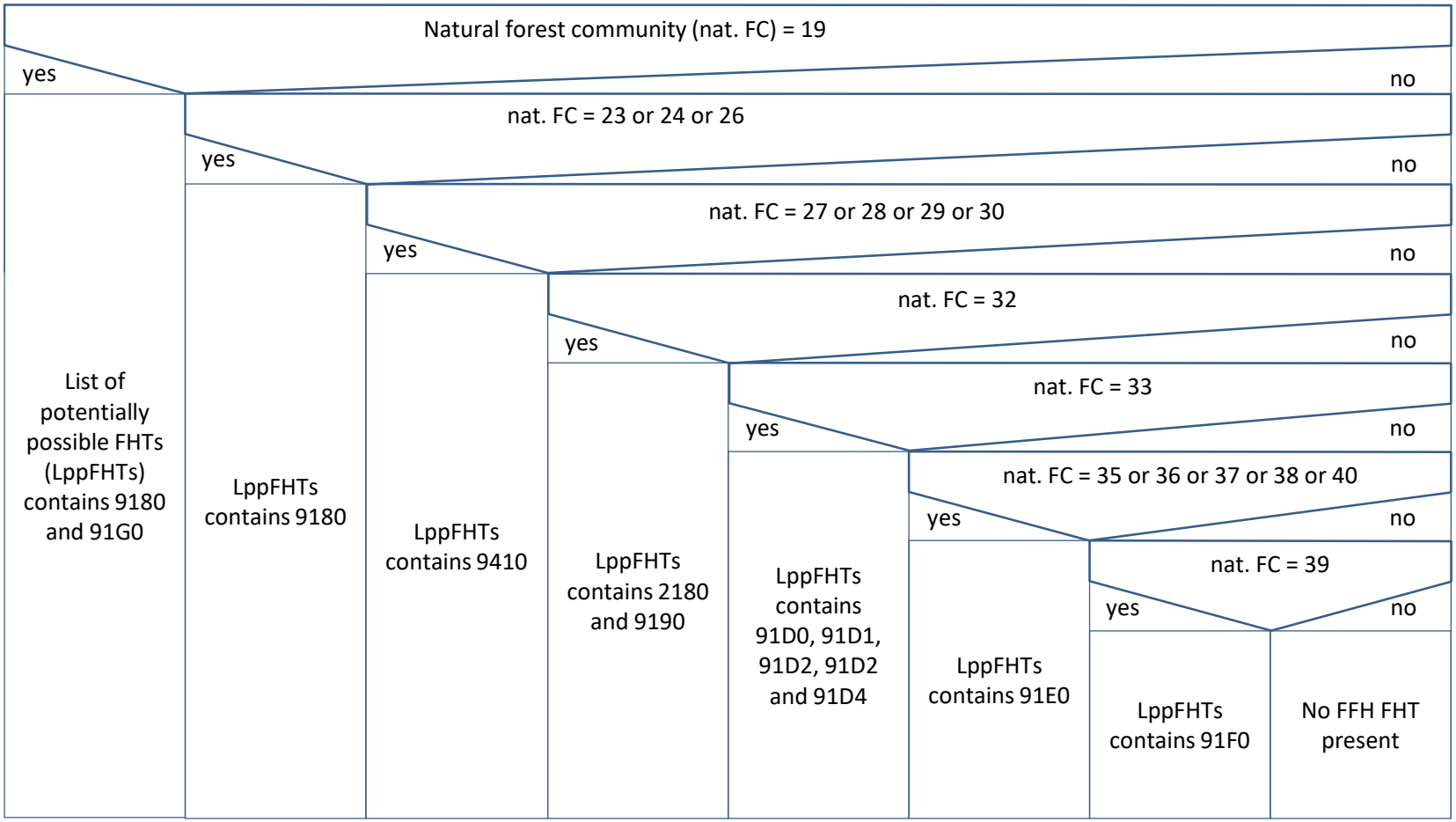
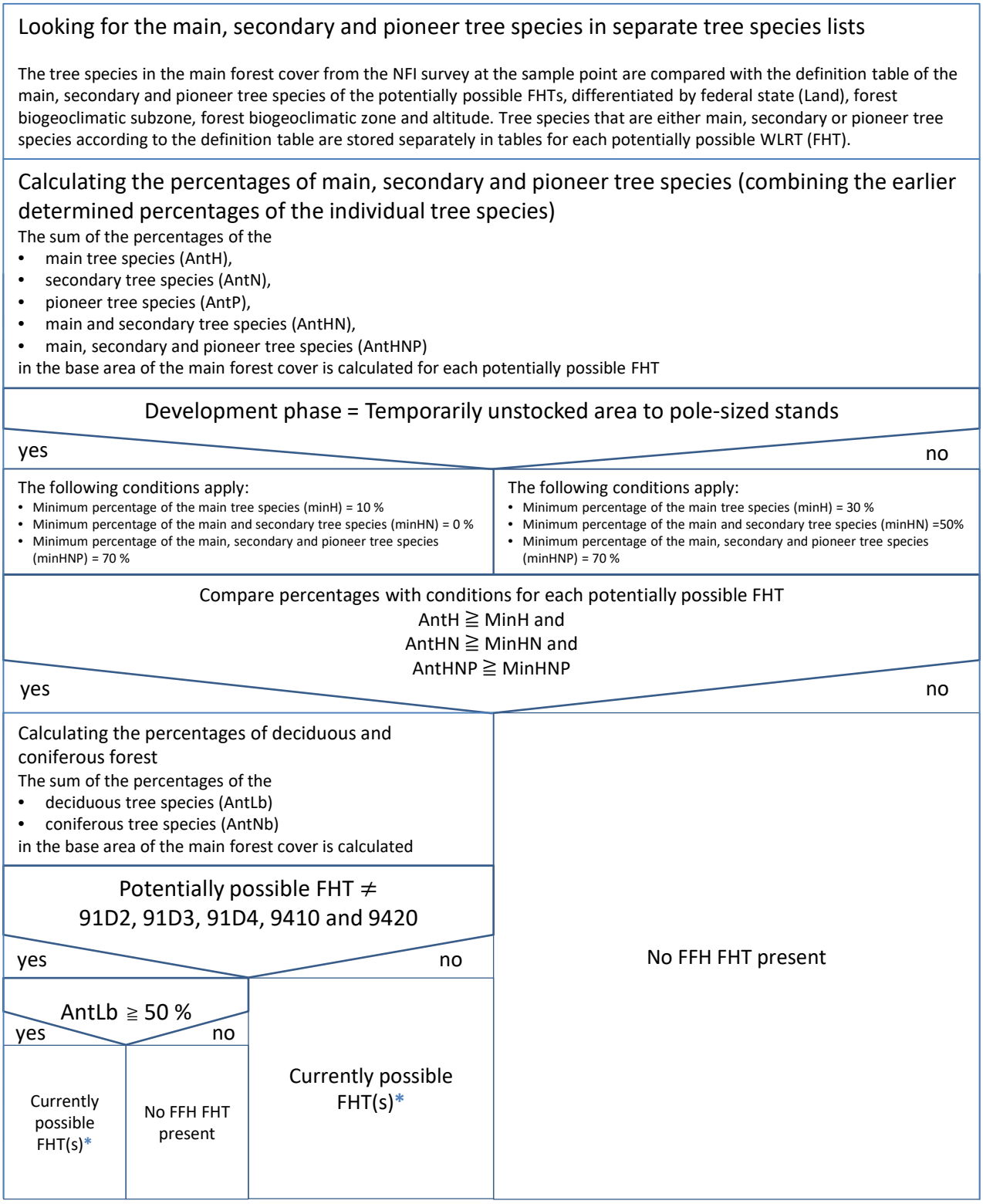


Module: "potnat-WLRT3"



Module: Bestockung

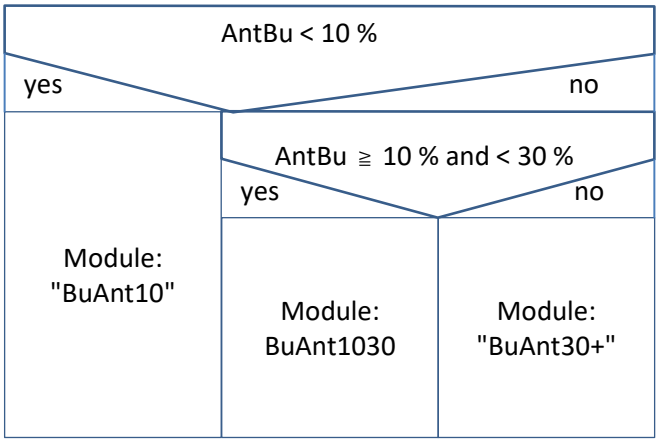


* The yes-or-no question "*Module "Bestockung" filters currently possible FHT(s) from list with potentially possible FHTs"* in the basic flow chart is answered with "yes"

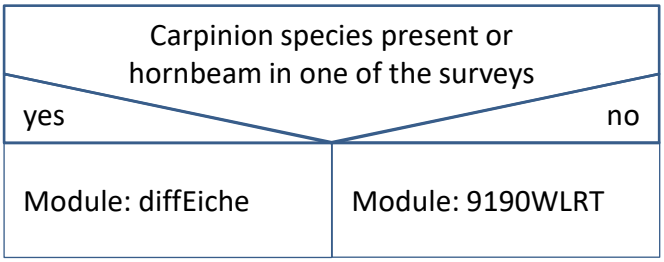
Module: BuEi-WLRTen

Calculating the percentage of the tree species
- beech (AntBu)

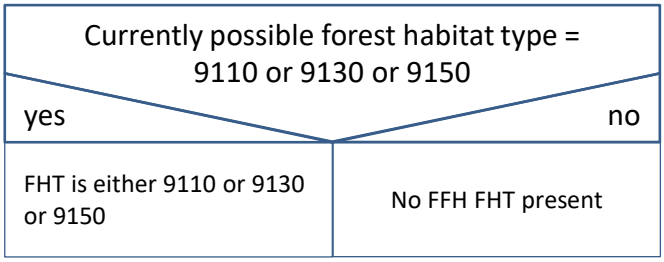
in the base area of the main forest cover



Module: BuAnt10



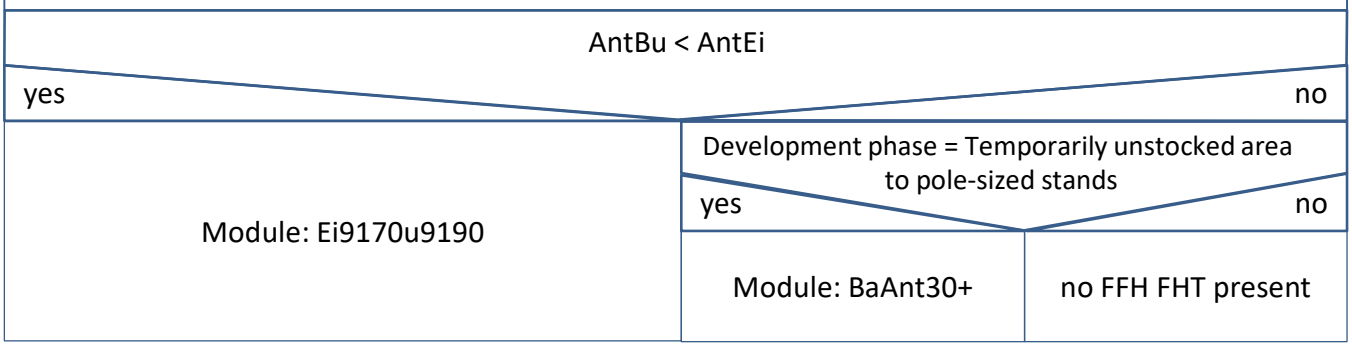
Module: BuAnt30+



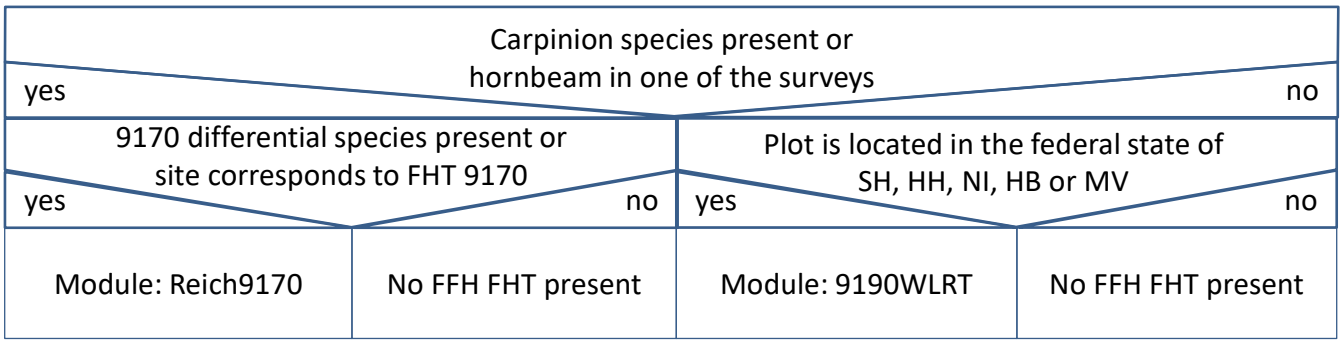
Module: BaAnt1030

Calculating the percentage of the tree species
- beech (AntBu)
- oak (AntEi)

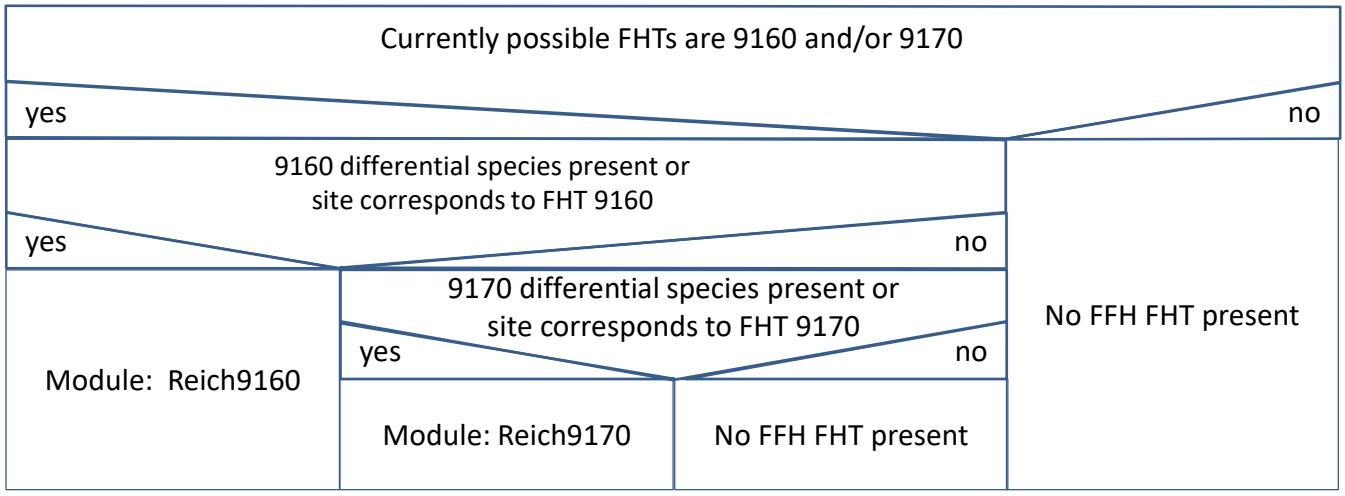
in the base area of the main forest cover



Module: Ei9170u9190



Module: diffEiche



Module: Reich9160

One of the following tree species occurs in the angle-count sampling 4 (WZP4) or in the angle-count sampling 1/2 (WZP1/2) or in the survey circles with r = 1 m, 2 m or 10 m:

- European ash
- Field maple
- Lime tree
- Elm
- Black alder
- Wild cherry

yes / no

FHT is currently 9160	No FFH FHT present

Module: Reich9170

One of the following tree species occurs in the angle-count sampling 4 (WZP4) or in the angle-count sampling 1/2 (WZP1/2) or in the survey circles with r = 1 m, 2 m or 10 m:

- European ash
- Field maple
- Lime tree
- Whitebeam
- Service tree
- Wild service tree
- Aspen
- Wild cherry
- Wild pear

yes / no

FHT is currently 9170	No FFH FHT present

Module: 9190WLRT

Currently possible FHT = 9190 and in the survey circle with r = 10 m:
Periodically dry to periodically wet sites with moor grass (Molinia caerulea) 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
Other sound basis (habitat maps, biotope maps, site maps, separate visual inspection by experts)

yes	no
FHT = 9190	No FFH FHT present

Module: MoorWLRT

Currently possible FHT = 91D0, 91D1, 91D2, 91D3, 91D4 and presence of a bog species in the survey circle with r = 10 m and peat thickness in the survey circle with r = 10 m ≧ 30 cm and 5 % of the 10 m-survey circle covered with Sphagnum

yes	no
Module: Moor	No FFH FHT present

Module: zu9180

Currently possible FHTs = 9180 and 91G0

yes	no
FHT = 91G0	FHT = 9180 or 91G0

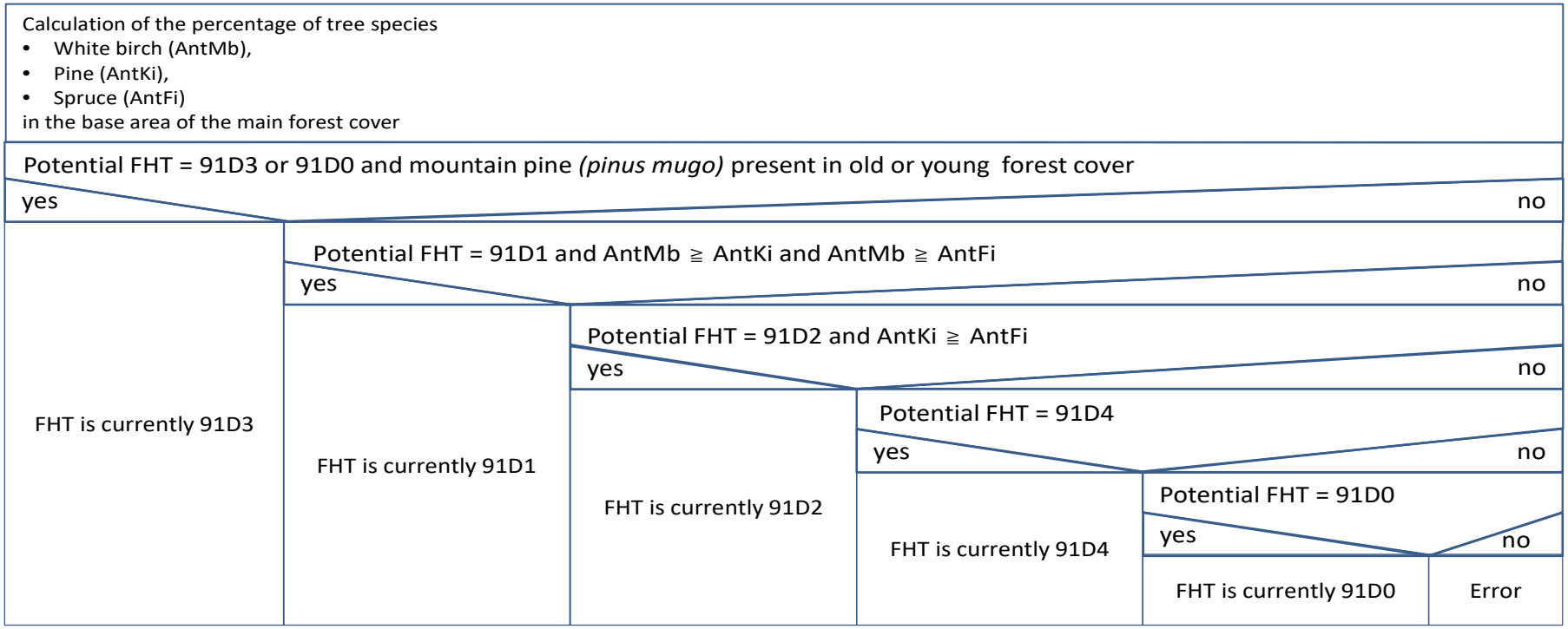
Module: zu 91F0

Currently possible FHTs = 91F0 and (9160 and/or 9170)

yes	no
Module: BuAnt10	Currently possible FHTs = 9170 and 9160

yes	no
Not defined – no FFH FHT present	FHT = 9160 or 9170 or 91F0

Module: "Moor"


Calculation of the percentage of tree species
• White birch (AntMb),
• Pine (AntKi),
• Spruce (AntFi)
in the base area of the main forest cover
Potential FHT = 91D3 or 91D0 and mountain pine (pinus mugo) present in old or young forest cover
yes
no
FHT is currently 91D3
Potential FHT = 91D1 and AntMb ≧ AntKi and AntMb ≧ AntFi
yes
no
FHT is currently 91D1
Potential FHT = 91D2 and AntKi ≧ AntFi
yes
no
FHT is currently 91D2
Potential FHT = 91D4
yes
no
FHT is currently 91D4
Potential FHT = 91D0
yes
no
FHT is currently 91D0
Error

Appendix 7: Habitat tree definition

There is no diameter threshold. This can be derived subsequently if needed from the angle-count sampling 4.

Habitat trees are living trees. One living bough suffices. Simultaneous recording as deadwood is excluded in all cases.

Attribute (multiple attributes possible)	NFI criteria
Trees with cavities	At least 1 cavity made by woodpeckers or caused by decomposition of branches
Specific habitat tree attributes	Living trees with DBH ≥ 40 cm (filtered from angle-count sampling if necessary during evaluation) • with stem rot > 500 cm² in the timber body • with loosening bark or bark pockets > 500 cm², minimum width 10 cm • with large fungal bodies such as fungi fruiting bodies or similar • with rotten or rotting trunk injury or a tree cavity containing wood mould that is large enough to insert the lower arm • more than one third of the upper crown dead • 3 thick deadwood branches (> 20 cm diameter and > 1.3 m length (estimated)) in lower crown • Slime or sap bleeding > 50 cm on deciduous trees
Eyrie trees	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)
Old trees *Fagus sylvatica* (beech), *Quercus sp.* (oak), *Acer pseudoplatanus* (sycamore maple), *Acer patanoides* (Norway maple*), Fraxinus sp*. (ash), *Ulmus sp*. (lime tree), *Populus°sp.* (Poplar), coniferous trees: DBH ≥ 80 cm All other species: DBH ≥ 40 cm	Living, very old trees (“Methuselah trees”), i.e. trees that due to their great age or their large dimensions already exhibit timber devaluating rot or abnormal heartwood with high probability. The latest possible utilisation age is in any case past; the attribute is derived from the DBH of angle-count sampling 4. Acc. to LANA-FCK Methuselah trees are filtered out of angle-count sampling.

Appendix 8: Threats and pressures

Impairment	A (no or minor threats and pressures)	B (average threats and pressures)	C (major threats and pressures)	Survey unit
Invasive woody plants[1)]	0 %	> 0 % and ≤ 10 %	> 10 %	10 m radius
Listed[2] **eutrophication indicator (changes to the typical nutrient balance)** Only to be surveyed among naturally meagre forest habitat types 9110, 9190, 91Dx	≤ 10 %	> 10 % and ≤ 50 %	> 50 %	10 m radius
Invasive herbaceous species (Uncontrolled occurrence of listed[3] non-native herbaceous plants)	0 %	> 0 % and ≤ 10 %	> 10 %	10 m radius
Driving tracks: Recognisable **tracks**[4)] of vehicles[5)] **off** of regular pathways[6)] and detail forestry accessibility lines[7)]	No	No	Yes	25 m radius
	and	and	or	
Number of detail forestry accessibility lines in a circle:				
in **priority** forest habitat types	0	> 0 and ≤ 1 ½, in 91D0: category B is not applicable	> 1 ½, in 91D0: > 0	
in **non-priority** forest habitat types	≤ 1	> 1 and ≤ 2 ½,	> 2 ½	

(1) Invasive woody plants: *Acer negundo* (box elder), *Ailanthus altissima* (tree of heaven), *Buddleja davidii* (summer lilac), *Fraxinus pennsylvanica* (red ash), *Fraxinus americana* (white ash), *Mahonia aquifolium* (Oregon grape), *Prunus laurocerasus* (cherry laurel), *Prunus serotina* (black cherry), *Rhus typhina* (sumac), *Robinia pseudoacacia* (black locust), *Symphoricarpus albus* (snowberry) (with regard to these woody plants, there is a risk of uncontrollable propagation or spread);

More information on these species: http://www.floraweb.de/neoflora/handbuch.html

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

(3) Invasive herbaceous species: *Heracleum mantegazzianum* (giant hogweed), *Fallopia japonica*, *F. sacchalinensis* (giant knotweeds), *Impatiens glandulifera* (Himalayan balsam), *Impatiens parviflora* (small balsam), *Phytolacca americana* (American pokeweed)

On driving tracks:

(4) E.g. visible ground compaction, damage or changes in herbaceous vegetation caused by vehicles (regardless of the time since driving occurred);

(5) this includes motor vehicles of all kinds and bicycles;

(6) historic formation of hollow ways that obviously have not been used for a longer period are not considered an impairment;

(7) these also include skid tracks and machinery tracks.

Appendix 9: Example of aggregation and attribute allocation

The following fictitious assessments were made for occurrences of a forest habitat type at 10 plots in a biogeographic region:

Plot	Tree species composition (old forest cover)	Tree species composition (young forest cover)	Tree species composition (main forest cover)	Peat moss coverage	Development phases*	Layers of forest cover	Deadwood stock*	Habitat trees*	Threats and pressures
1	A	np	np	np	C	C	C	C	B
2	C	np	np	np	C	C	C	C	C
3	np	B	np	np	B	C	C	B	B
4	B	C	C	np	C	A	C	C	B
5	C	C	C	np	C	B	C	C	B
6	B	A	A	np	C	B	B	A	B
7	B	B	B	np	B	B	B	C	B
8	A	C	A	np	C	A	A	C	B
9	A	B	A	B	A	B	C	C	A
10	B	np	np	A	C	C	C	C	B

np = not present = not assessed

* = assessed at the level of the physiographic large-scale regions or the biogeographic regions with the results subsequently carried back to the relevant plots

The tree species composition in the old, young and main forest cover, the peat moss coverage, the forest cover layers and the threats and pressures are assessed at the individual sample plot. To assess the attributes "development phases", "deadwood" and "habitat trees", the measured values for many individual sample plots at the level of the physiographic large-scale regions or the biogeographic regions are summarised and this value is then carried over to the relevant plots.

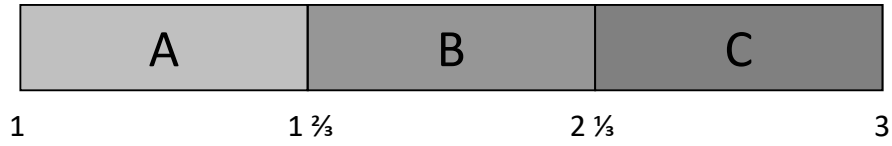
For deadwood volume, the timber stock per hectare is calculated for each development phase in the forest cover in a physiographic large-scale region or a biogeographic region and then assessed. The assessment result of a development phase is used for each plot in this development phase.

Three different allocation methods are used for the aggregation of the assessment results: (1) allocation according to the Pinneberg scheme, (2) allocation of the threats and pressures and (3) allocation with the help of a numeric scale (see Chapter 3.2.5).

(1) Allocation according to the Pinneberg scheme aggregates the values of three input parameters to one single value. This scheme is applied to generate the scale grade of the criteria group "tree species composition in the forest cover" (see Table 20) if both old and young forest cover occur and to determine the specific structures and functions from the three attribute groups "species inventory", "habitat structures" and "threats and pressures" (see Table 21).

(2) As described in Chapter 3.1.10, when allocating the threats and pressures, the attribute with the poorest assessment result of the attribute group "threats and pressures" determines the scale grade of the entire group.

(3) Allocation with the help of a numeric scale is always used for aggregation purposes if more or fewer than three different attributes must be aggregated. The ordinal scale grades A, B and C are first converted into the numerical values 1, 2 and 3 (A → 1, B → 2, C → 3) before the arithmetic mean is calculated. A mean value > 2 ⅓ is “C”, a mean value > 1 ⅔ and ≤ 2 ⅓is “B”, a mean value ≤ 1 ⅔ is “A”.



If there is either only old forest cover or only young forest cover and if peat moss coverage is not assessed, the attribute group "species inventory" can be directly assessed without aggregation (plots 1-3). But if, on the other hand, both old and young forest cover occur at a plot, the separate A/B/C assessments of the old, young and main forest cover available for each plot are first aggregated at equal weighting to the criteria attribute "tree species composition in the forest cover" using the Pinneberg allocation scheme (see Table 20) (plots 4-8). In non-peat bog forest habitat types, the assessment of the species inventory is equal to the assessment of the tree species composition in the forest cover (plots 1-8). In peat bog forest habitat types, the assessments of the peat moss coverage and the tree species composition in the forest cover are aggregated at equal weighting, using a numerical scale, to assess the species inventory (plots 9-10).

The aggregation result in the attribute group "species inventory" is as follows:

Plot	Assessment of the single attributes of the attribute group "species inventory"				Aggregation in the attribute group "species inventory"				
	Tree species composition (old forest cover)	Tree species composition (young forest cover)	Tree species composition (main forest cover)	Peat moss coverage	Tree species composition in the forest cover: A/B/C	Tree species composition in the forest cover: numerical scale	Peat moss coverage: numerical scale	Tree species composition in the forest cover and peat moss coverage: mean value	Species inventory: result
1	A	np	np	np	A	--	--	--	A
2	C	np	np	np	C	--	--	--	C
3	np	B	np	np	B	--	--	--	B
4	B	C	C	np	C	--	--	--	C
5	C	C	C	np	C	--	--	--	C
6	B	A	A	np	A	--	--	--	A
7	B	B	B	np	B	--	--	--	B
8	A	C	A	np	B	--	--	--	B
9	A	B	A	B	A	1	2	1.5	A
10	B	np	np	A	B	2	1	1.5	A

np = not present = not assessed

-- = not required

The assessments of the attributes "development phases", "layers / structure of the forest cover", "deadwood" and "habitat trees" are aggregated at equal weighting, using a numerical scale, to the attribute group "habitat structures". The aggregation result in the attribute group "habitat structures" is as follows:

Plot	Assessment of the single attributes of the attribute group "habitat structures"				Aggregation in the attribute group "habitat structures"					
	Development phases*	Layers of forest cover	Deadwood stock*	Habitat trees*	Development phases*	Layers of forest cover	Deadwood stock*	Habitat trees*	Attribute group "habitat structures"	
	A/B/C assessments				Numerical scale				Mean value	Result
1	C	C	C	C	3	3	3	3	3.00	C
2	C	C	C	C	3	3	3	3	3.00	C
3	B	C	C	B	2	3	3	2	2.50	C
4	C	A	C	C	3	1	3	3	2.50	C
5	C	B	C	C	3	2	3	3	2.75	C
6	C	B	B	A	3	2	2	1	2.00	B
7	B	B	B	C	2	2	2	3	2.25	B
8	C	A	A	C	3	1	1	3	2.00	B
9	A	B	C	C	1	2	3	3	2.25	B
10	C	C	C	C	3	3	3	3	3.00	C

* = assessed at the level of the physiographic large-scale regions or the biogeographic regions with the results subsequently carried back to the relevant plots

The assessments of the attributes "invasive woody plants", "invasive herbaceous species", eutrophication indicators", "driving tracks off of regular pathways" and "detail forestry accessibility lines" are aggregated to the attribute group "threats and pressures" with the poorest individual assessment being decisive for the result (not shown here in detail).

In a final step, the assessment results of the attribute groups "species inventory", "habitat structures" and "threats and pressures" are aggregated at equal weighting using the Pinneberg scheme to obtain the assessment result for the "specific structures and functions" of a forest habitat type at a plot.

Plot	Attribute groups			Assessment result for the parameter "specific structures and functions" of a forest habitat type at a plot
	Species inventory	Habitat structures	threats and pressures	
	A/B/C assessments			A/B/C assessment
1	A	C	B	B
2	C	C	C	C
3	B	C	B	B
4	C	C	B	C
5	C	C	B	C
6	A	B	B	B
7	B	B	B	B
8	B	B	B	B
9	A	B	A	A
10	A	C	B	B

If the plots each represent an area of 4 km², we would gain the following result for the A, B and C area percentages of the forest habitat type in the biogeographic region:

Assessment grade:	Number of plots	Area	Percentage
A	1	4 km²	10 %
B	6	24 km²	60 %
C	3	12 km²	30 %

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