

**COST Action E43**

*Harmonisation of National Forest Inventories in Europe: Techniques for Common Reporting*

**Working Group 3**

# Deadwood assessment within European National Forest Inventories

**Prof. J. RONDEUX**

**Gembloux Agricultural University  
Belgium**

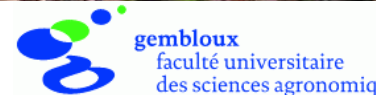
**20-24th March 2007  
Firenze, Italy**



**Cost E43 WG3 Biodiversity- Task Force Meeting**



**ICP Forests Expert Panel Biodiversity and Ground Vegetation  
Meeting**



# Contents

1. Introduction
2. WG3 - questionnaire II - Results
3. Proposed indicators
4. Discussion - Conclusion





# 1. Introduction



# Importance of deadwood



## > Indicator of forest biodiversity

Habitat for many organisms:

- insects
- fungi
- epixylic lichens and bryophytes
- arthropods
- mammals
- birds

## > Key factor in the nutrient cycle



### Needs for deadwood quantification

- Large scale surveys [NFIs]
- Nature reserves [specific inventories]

In April 2006, questionnaires concerning dead wood sampling in National Forest Inventory (NFI) were fulfilled by 19 European countries

AT, BE, CZ, EE, FI, FR, DE, GR, HU, IT, LV, LT, NO, RO, SK, ES, SE, CH, UK

**No data collected for deadwood**

Based on questionnaire results, the first version was presented by J. Rondeux the 4<sup>th</sup> May 2006 in Bordeaux (FR) to the 6<sup>th</sup> joint Working group and Management Committee Meeting

**BUT**: The analysis of questionnaires indicates that some questions were ambiguous and/or generated ambiguous answers.

**THUS**: Additional questions were sent to 13 countries among them only 9 countries responded to it:  
AT, FR, LV, LT, SK, IT, ES, SE, CH

→ Results about 16 countries inventoring the dead wood

## WG3 - questionnaire I I



<b>Country Name</b>	<b>Abbreviation</b>
<b>Austria</b>	<b>AT</b>
<b>Belgium</b>	<b>BE</b>
<b>Czech Republic</b>	<b>CZ</b>
<b>Estonia</b>	<b>EE</b>
<b>Finland</b>	<b>FI</b>
<b>France</b>	<b>FR</b>
<b>Germany</b>	<b>DE</b>
<b>Greece</b>	<b>GR</b>
<b>Hungary</b>	<b>HU</b>
<b>Italy</b>	<b>IT</b>
<b>Latvia</b>	<b>LV</b>
<b>Lithuania</b>	<b>LT</b>
<b>Norway</b>	<b>NO</b>
<b>Romania</b>	<b>RO</b>
<b>Slovakia</b>	<b>SK</b>
<b>Spain</b>	<b>ES</b>
<b>Sweden</b>	<b>SE</b>
<b>Switzerland</b>	<b>CH</b>
<b>United Kingdom</b>	<b>UK</b>



## 2. WG3 - questionnaire II - Results

# Deadwood definition

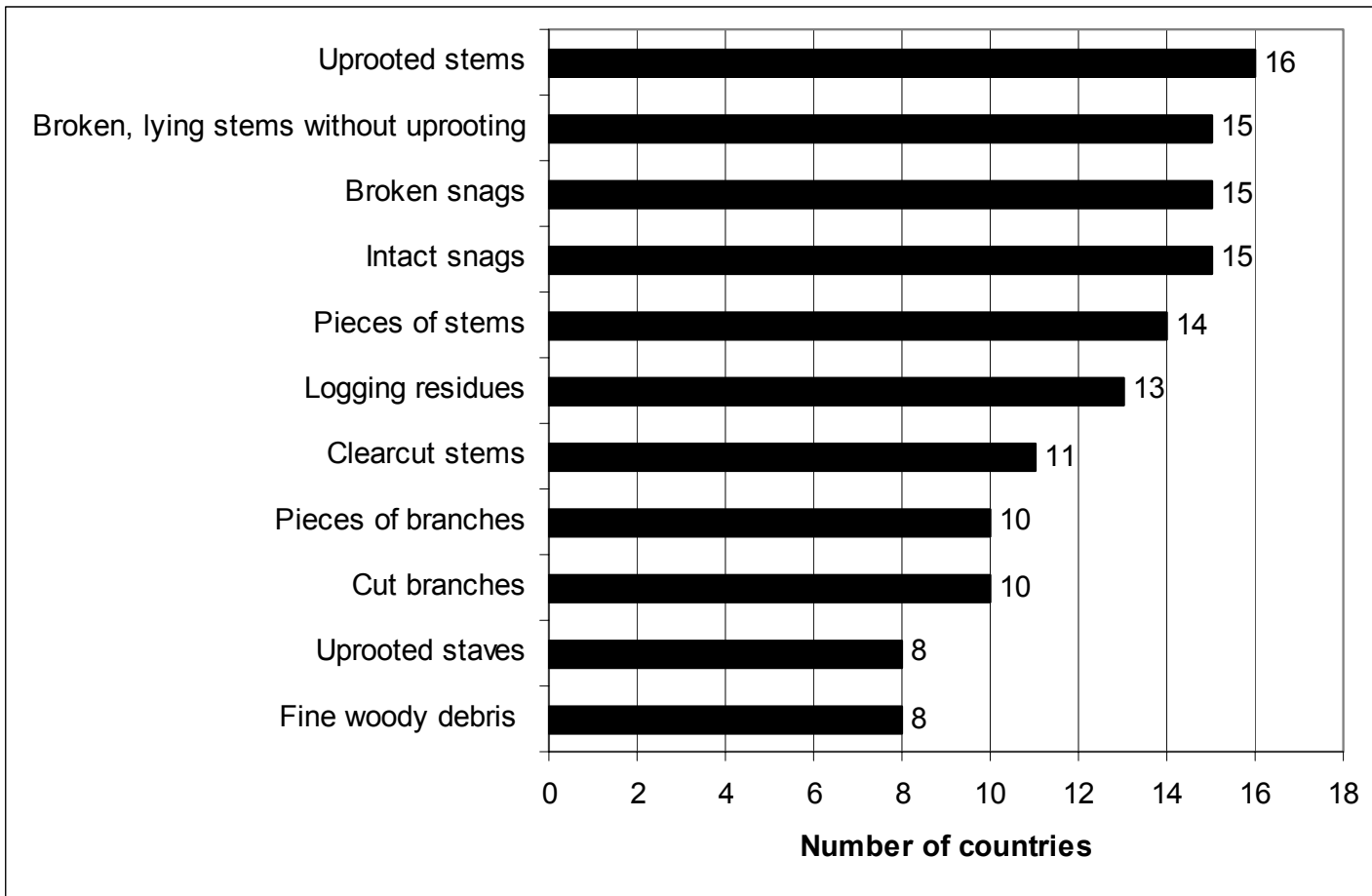
What is included in your definition of deadwood?

<b>Uprooted stems</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, FR, IT, LT, LV, NO, SK, SE, UK</b>
<b>Clearcut stems</b>	<b>BE, EE, ES, FI, FR, IT, LV, NO, SK, SE, UK</b>
<b>Pieces of stems</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, IT, LV, NO, SK, SE, UK</b>
<b>Pieces of branches</b>	<b>AT, BE, CH, CZ, DE, ES, IT, LV, SK, UK</b>
<b>Cut branches</b>	<b>AT, BE, CH, CZ, DE, ES, IT, LV, SK, UK</b>
<b>Uprooted staves</b>	<b>AT, BE, CH, CZ, DE, ES, IT, SK</b>
<b>Logging residues</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, IT, LV, NO, SK, UK</b>
<b>Fine woody debris</b>	<b>AT, BE, CZ, EE, LV, SK, SE, UK</b>
<b>Intact snags</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, FR, IT, LV, NO, SK, SE, UK</b>
<b>Broken snags</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, FR, IT, LV, NO, SK, SE, UK</b>
<b>Broken, lying stems without uprooting</b>	<b>AT, BE, CH, CZ, DE, EE, ES, FI, IT, LT, LV, NO, SK, SE, UK</b>

**Table 1:** List of countries including the following elements in their definition of deadwood

# Deadwood definition

What is included in your definition of deadwood?



**Figure 1:** Number of countries including the following elements in their definition of deadwood.

# Deadwood definition



What is included in your definition of deadwood?

Proposed definitions:

<b>Uprooted stems</b>	Tree on the ground resulting from uprooting (windthrown)
<b>Clearcut stems</b>	Tree on the ground resulting from cutting
<b>Pieces of stems</b>	Part or fragment of dead stem
<b>Pieces of branches</b>	Part or fragment of crown
<b>Pruned branches</b>	Branches resulting from pruning
<b>Uprooted staves</b>	?
<b>Logging residues</b>	All dead woods resulting from logging (except clearcut stems)
<b>Fine woody debris</b>	Twig, fine dead wood piece, threshold?
<b>Intact snags</b>	Entire standing dead tree
<b>Broken snags</b>	Broken standing dead tree (intact snag after break damage)
<b>Broken, lying stems without uprooting</b>	Part of broken snag ?



# Deadwood sampling

**Table 2:** Number of countries using the different thresholds according to the different deadwood types.

Minimum diameter	(1) Snags (DBH)	(2) Uprooted trees and stems	(3) Lying deadwood
4 cm	1 [SE]	1 [SE]	1 [SE]
5 cm	2 [AT, UK]	2 [CH, UK]	2 [CH, UK]
6.1 cm	1 [LV]	1 [LV]	1 [LV]
6.4 cm	1 [BE]	1 [BE]	1 [BE]
7 cm	1 [CZ*]	2 [CZ*, SK]	2 [CZ, SK**]
7.5 cm	2 [ES, FR]	2 [ES, FR]	2 [FR***, ES]
10 cm	3 [FI, NO, IT]	3 [FI, NO, IT]	3 [FI, NO, IT]
12 cm	1 [CH]		
15 cm	2 [EE, SK]	1 [EE]	1 [EE]
20 cm	1 [DE]	2 [AT, DE]	2 [AT, DE]

The deadwood types are:

(1) **Snags:**

Intact snags and broken snags.

(2) **Uprooted trees and stems:**

Uprooted stems and uprooted staves.

(3) **Lying deadwood:**

Clearcut stems, pieces of stems, pieces of branches, cut branches, logging residues, fine woody debris, broken and lying stems without uprooting.

# Deadwood sampling

**Table3:** : Number of countries using the different length according to the different deadwood types.

Minimum length	(1) Snags (DBH)	(2) Uprooted trees and stems	(3) Lying deadwood
No	2 [AT, FR]	2 [AT, FR]	1 [AT]
10 cm	-	2 [CZ, DE]	2 [CZ, DE]
30 cm	-	1 [ES]	1 [ES]
50 cm	-	-	1 [LV]
60 cm	-	1 [NO]	1 [NO]
100 cm	1 [EE]	4 [BE, EE, SK, UK]	4 [BE, EE, SK, UK]
130 cm	6 [CH, CZ, DE, FI, NO, SE]	2 [FI, SE]	2 [FI, SE]

The deadwood types are:

(1) **Snags:**

Intact snags and broken snags.

(2) **Uprooted trees and stems:**

Uprooted stems and uprooted staves.

(3) **Lying deadwood:**

Clearcut stems, pieces of stems, pieces of branches, cut branches, logging residues, fine woody debris, broken and lying stems without uprooting.

# Deadwood sampling

**Table 4:** Presentation of number of plots, plot area and forest area for each country (based upon available information).

Country	Number of Dead wood plots	Dead wood plot area (m <sup>2</sup> )	Forest area (ha)**
AT	10000***	300	3844000
BE	10800***	VAR *	544800
CH	6500***	LIS	1173200
CZ	14500	500	2705000
DE	-	-	11075800
EE	1000	314	2284600
ES	***	706.86 *	13904700
FI	66000	154	25699000
FR	70000***	700	14809600
IT	7000***	530	8759200
LT	5500***	VAR *	2069400
LV	10000***	500	2923000
NO	10000	250	7500000
SE	43000***	VAR *	27414000
SK	16000***	LIS	1929300
UK	-	VAR *	2544600

\* this area is a part of the main plot of the NFI (subplot)

\*\* the forest area is issued from WG1

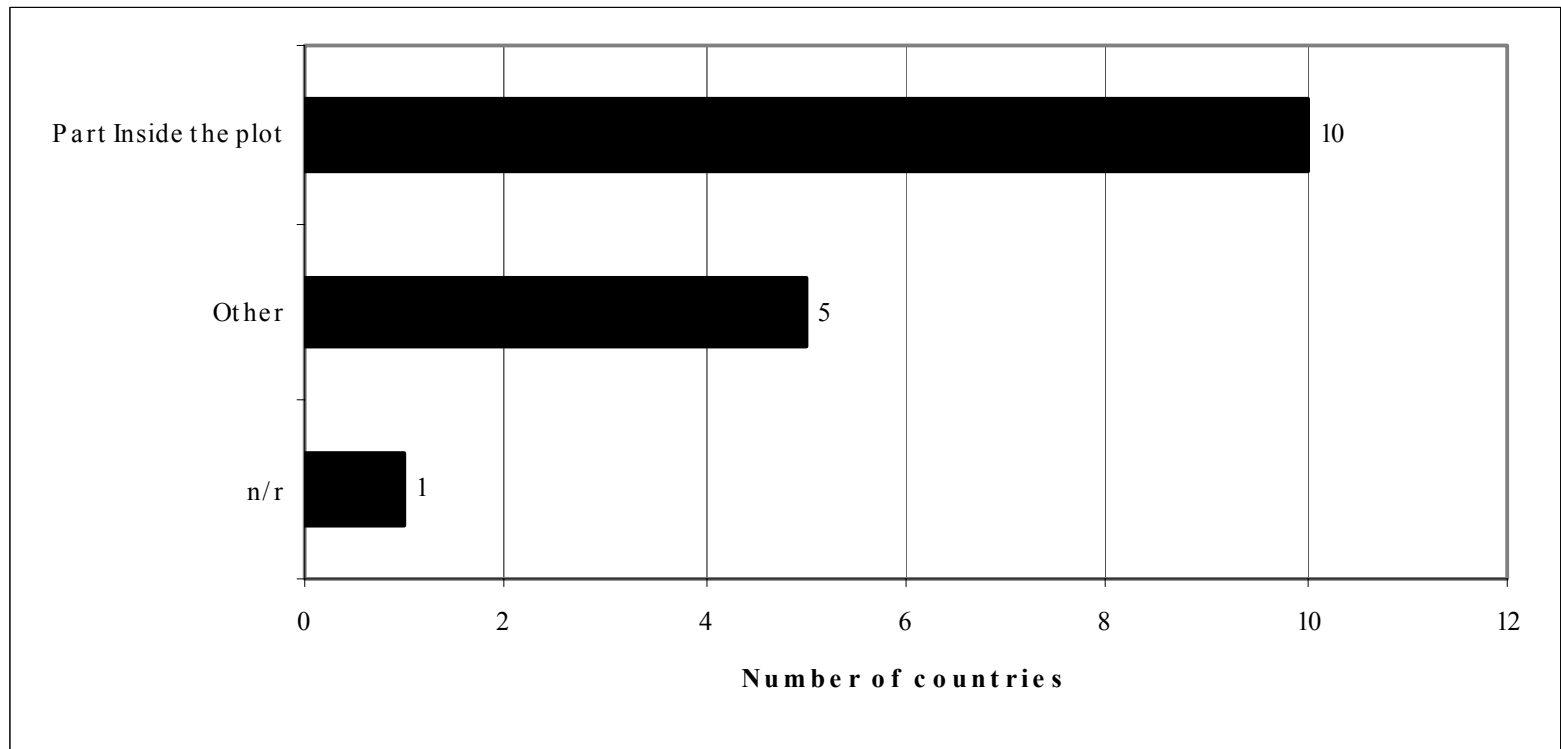
\*\*\* concerning countries who responded to the additional questions: same than the NFI plot number (no sub-sample)

	Snags (DBH)	Uprooted trees and stems	Lying deadwood
BE	As living trees : Radius = 4.5m C150<70cm Radius = 9m 70cm= < C150< 120cm Radius = 18m C150 >= 120cm	Radius = 4.5m CMOY<70cm Radius = 9m 70cm= < CMOY< 120cm Radius = 18m CMOY >= 120cm	
CH	Radius = 7.98 m Radius = 12.62 m	Transects: 3 x 10 m	Transects: 3 x 10 m
ES	Radius = 5 m Min DIAM = 7.5 cm Radius = 10 m Min DIAM = 15.5 cm Radius = 15 m Min DIAM = 22.5 cm Radius = 55 m Min DIAM = 42.5 cm	Radius = 15 m	Radius = 15 m
LT		Radius = 2.82m 2.1cm=<DBH<6.1cm Radius = 5.64m 6.1=<DBH<14.1cm Radius = 12.62 m DBH>14.1cm	
SE	Radius = 3.5m Min DIAM = 4-10 cm Radius = 7m (temporary plots) or Radius = 10m (permanent plots) Min DIAM = 10 cm	Radius = 7m (temporary plots) or Radius = 10m Min DIAM = 10 cm	
SK	-	Transect: 2 x 25.4 m	Transect: 2 x 25.4 m
UK		Radius = 4m Dead trees with DBH<7cm Radius = 8m Lying dead wood with mid-DIAM>5cm Radius = 5.6 or 8 or 12.6 m determined by the need to have 7-20 live trees with DBH> 7 cm Dead trees with DBH >7cm	

**Table 5:** Description of the criteria used in the case of variable area plot (VAR) and transect plot

# Deadwood sampling

**Figure 2:** How lying stems crossing the sample plot border are measured ?



**LT, CH, SK:** *Other* means « measuring points » inside the plot (3/5)

**(2/5): ES :** the pieces are completely measured if 50% of their length is inside the plot

**DE :** the pieces are completely measured if their thick end is inside the plot

# Deadwood sampling



Are changes assessed in deadwood through time ?

**Table 6:** Countries recording changes in deadwood through time

Yes	No
AT, BE, CH, DE, EE, FI, LT, LV, NO, SE	CZ, ES, FR, IT, SK

How is total volume of deadwood calculated ?

**Table 7 :** Number of countries using the different volume calculation methods according to different deadwood types.

	Standing deadwood (Snags)	Lying deadwood
Volume function	8 [BE, CH, DE, ES if DBH>7.5cm, FI, FR, NO, SE]	2 [FR (for windthrow and clearcut trees), BE (for logging residues)]
Cylinder formula	4 [BE if broken, CZ, LT, IT]	8 [AT, BE, CZ, DE, IT, LT, NO, SE]
Truncated cone	2[SK, ES (DBH 2.5-7.5)]	2 [ES for windthrow trees, FI]
Smalian	-	1 [ES for lying branches]
Bitterlich	1 [AT]	-
Line Intersect Sampling	-	2 [CH, SK]

- UK NFI do not estimate the dead wood volume.
- EE did not precise which method is used to estimate the dead wood volume.
- LV NFI use several formulas depending on tree species and type of dead wood.

# Deadwood description

At which taxonomic level is deadwood recorded ?

**Table 8:** Number of countries using the different taxonomic levels according to the deadwood type.

<b>Taxonomic level</b>	<b>Standing deadwood (Snags)</b>	<b>Lying deadwood</b>
<b>Species</b>	<b>13</b>	<b>12</b>
<b>Hardwood/softwood</b>	<b>3 [CZ, DE, IT]</b>	<b>3 [BE, DE, IT]</b>
<b>No identification</b>	<b>-</b>	<b>1 [CZ]</b>

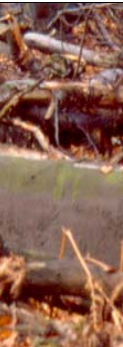
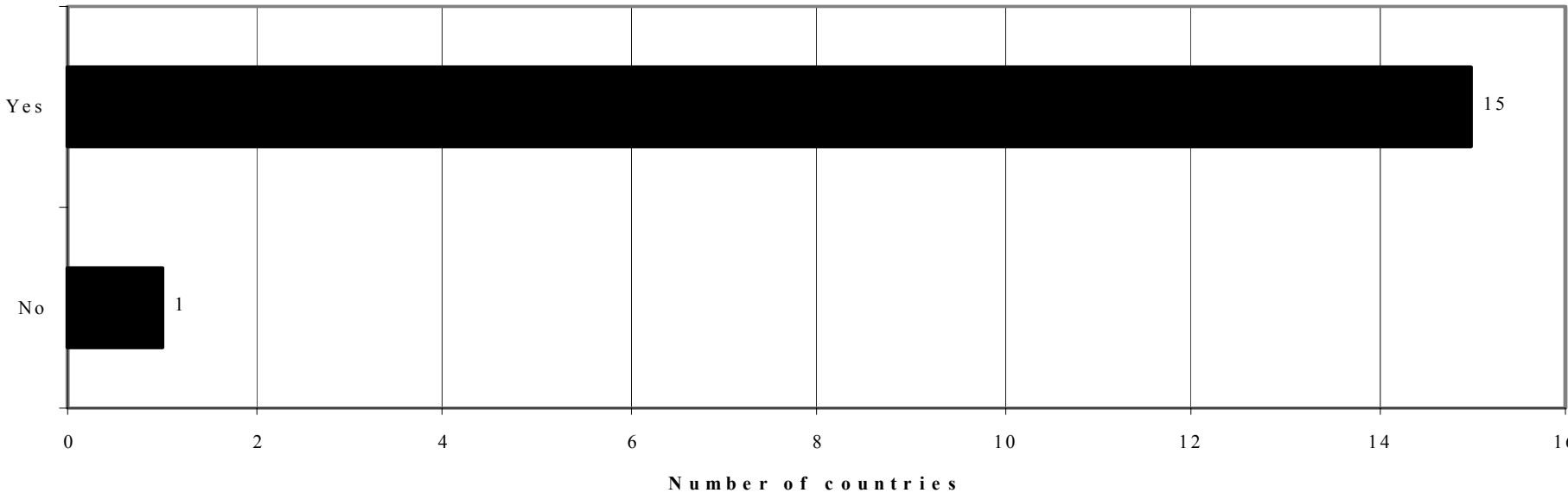
**Table 8bis:** If species identification is not possible:

<b>Taxonomic level</b>	<b>All deadwood</b>
<b>Hardwood/softwood</b>	<b>5 [CH, FI, SE, SK, UK]</b>
<b>Unidentified</b>	<b>7 [AT, BE, EE, ES, LT, LV, NO]</b>

# Deadwood description



Are specific biodiversity data collected ?



**Figure 3** : Do you measure biodiversity parameter ?

# Deadwood description

Which specific biodiversity data are collected ?

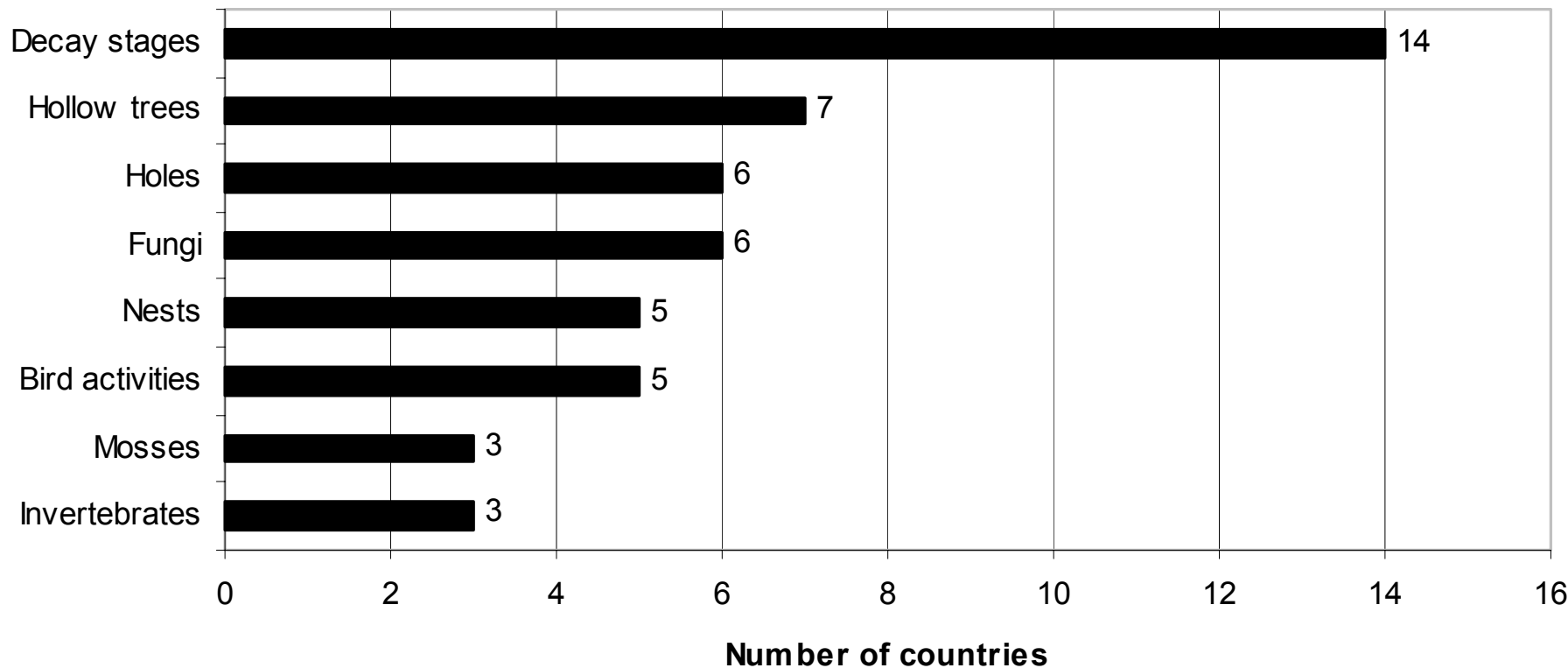
	<b>Countries</b>
<b>Invertebrates</b>	DE, EE, SE
<b>Mosses</b>	CH, SE, SK
<b>Bird activities</b>	CH, DE, EE, ES, SE
<b>Nests</b>	CZ, EE, ES, SE, SK
<b>Fungi</b>	CH, CZ, DE, EE, ES, SE
<b>Holes</b>	CH, CZ, DE, ES, SE, UK
<b>Hollow trees</b>	CZ, DE, EE, ES, SE, SK, UK
<b>Decay stages</b>	AT, BE, CH, CZ, DE, ES, FI, IT, LV, LT, NO, SE, SK, UK

**Table 9:** List of different countries which inventory the different biodiversity parameters

# Deadwood description



Which specific biodiversity data are collected ?



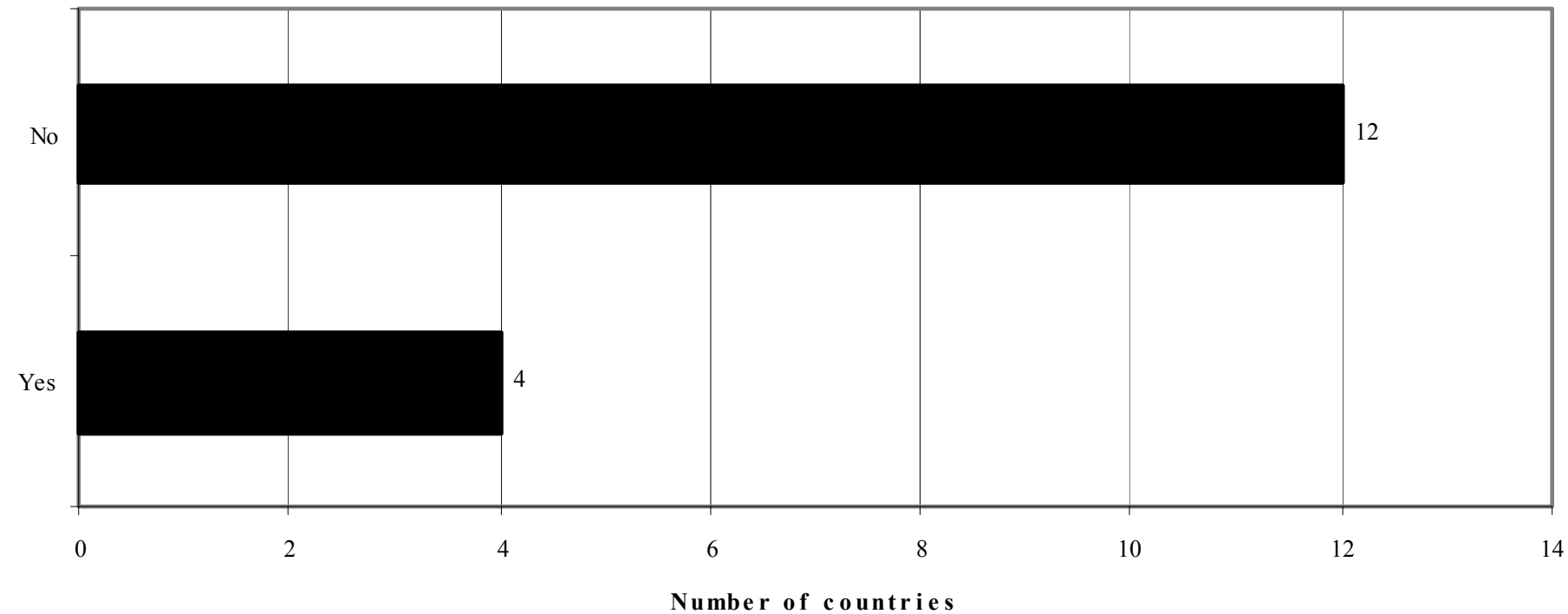
**Figure 4 :** Number of countries which describe biodiversity parameters



# Deadwood description



Which specific biodiversity data are collected ?



**Table 11:** Are nesting trees identified?

# Deadwood description

Which specific biodiversity data are collected ?

**Table 10:** Number of decay classes used in European NFIs

	Number of classes (decay stages)
2	AT, LT
3	BE, LV, UK
4	CZ, DE, SK
5	CH, FI, IT, NO, SE
7	ES

Exemples:

BE (3): 1) Not decomposed, 2) in progress and 3) advanced.

NO (5):

Class	Stage of decomposition
I	recently dead: bark normally attached to the wood, any fungus mycelicum developed under patches of loose bark
II	weakly decayed: loose bark, the rot extends less than 3 cm radially into the wood
III	medium decayed: the rot extends more than 3 cm into the wood (the log still has a hard core)
IV	very decayed: the rot extends deeply throughout the log, which is shaped by the contours of the forest floor (cross section often collapsed to an ellipsoid).
V	almost decomposed: the log is completely decomposed in sections and the fragments are often overgrown



## 3. Proposed indicators

## Deadwood indicators



### **Volume of deadwood (standing + lying)**

Quantity ( $\text{m}^3/\text{ha}$ )

- of deadwood in a forest type/region/country/etc
- of deadwood per decay class
- of deadwood per species or group of species (hardwood, softwood)

### **Ratio: deadwood volume / living volume**

- Volume ( $\text{m}^3/\text{ha}$ ) of all deadwood
- Volume ( $\text{m}^3/\text{ha}$ ) of living trees (growing crop)
- per forest type



## 4. Discussion - Conclusion



### State of the art for deadwood assessment

- not even 2 countries assess deadwood the same way
- probably due to this “new” need and time to spend to collect additional data
- too much room is always left for ambiguous interpretations

### Propose harmonised definitions (*references*) for deadwood assessment

=> preserve largest similarities of different national concepts

### Provide bridges and conversion functions

=> for comparable results (common reporting)