



# Protocol for standing timber quality assessment of valuable broadleaves



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# AIMS AND STRUCTURE OF THE PROTOCOL

The aim of this protocol is to facilitate the assessment of standing timber quality, as well as the possible industrial destinations of the principle, valuable broadleaved species, especially oak, ash, maple, cherry and chestnut, but also walnut, service and pear trees. Our aim is to create a tool which will help forest owners and practitioners responsible for forest management to make a rapid assessment of the potential for valuable timber generation of these species of trees at various stages. This should ultimately help in designing silvicultural interventions and integrating single-tree silviculture criteria in order to generate added value timber products.

The protocol consists of **two modules**:

**Module 1. Assessment of the potential for timber quality production of standing small and intermediate trees (DC10-25/30):** this allows us to identify trees that are likely to generate added value timber products in the future, so that they can be promoted through pruning and/or selective thinning depending on their development status.

**Module 2. Assessment of standing timber quality in intermediate and large trees (DC25+):** this allows us to assess the timber quality of standing trees and helps decide whether to apply silvicultural intervention, e.g. selective thinning or felling.

There are **four annexes**:

**Annex 1. Examples of field charts for assessing timber quality at stand level**

**Annex 2. Quality requirements of particular species and roundwood assessment:** we introduce specific quality requirements of oak, ash, maple, cherry and chestnut, to allow for a more detailed assessment of these species.

**Annex 3. Identification of the species of interest:** illustrated sheets to facilitate identification of the main species covered in this protocol, in various periods of the year and states of development.

**Annex 4. References:** main sources of information used to prepare this protocol.



# PROTOCOL FOR STANDING TIMBER QUALITY ASSESSMENT

## Module 1 Assessment of the potential for timber quality production of standing small and intermediate trees (DC10-25/30)

<b>Aim:</b> facilitate detection of trees likely to generate added value timber products in the future
<b>Tree dimensions:</b> diameter at breast height: 7.5-32.5 cm (oak) or 7.5 - 27.5 cm (other broadleaves)
<b>Data source:</b> contributions from experts in forest management and timber quality assessment
<b>Implications for management:</b> <ul style="list-style-type: none"> <li>• At <u>single tree level</u>: identification and marking of trees that are likely to become future crop trees; decision on the application of pruning and/or selective thinning.</li> <li>• At <u>stand level</u>: assessment of the aggregated stand potential and planning of specific interventions to increase this, including gap opening to induce regeneration, enrichment planting...</li> </ul>
<b>Determining tree potential:</b> <p>The features required by a small or intermediate tree in order to be considered for <b>promotion through specific silviculture interventions</b> are:</p> <ul style="list-style-type: none"> <li>• High vitality, dense crown not compressed vertically</li> <li>• Absence of relevant wounds or rot</li> <li>• At least one log (&gt;250 cm long) without live branches &gt; 6 cm (oak); &gt; 4 cm (other species)</li> <li>• All the visible knots and branches appear on parts of the stem with diameter &lt; 20 cm</li> <li>• Log with inclination &lt;10° and curvature &lt; 3 cm/m (see <a href="#">Figure 1</a>)</li> <li>• Cherry: without dead branches with Ø&gt;3 cm</li> <li>• In Mediterranean areas: ash, maple and cherry NOT located in crests or SW aspect</li> </ul>



Figure 1. left (foreground): tree with an inclination of  $10^\circ$ ; right: tree with curvature of 3 cm/m.

Annex 1 provides a proposal for a field chart to record the results of this module at stand level.

Module 2 Assessment of standing timber quality in intermediate and large trees (DC25+)

<b>Aim:</b> to assess the timber quality of standing broadleaves based on their morphological features			
<b>Tree dimensions:</b> diameter at breast height >22.5 cm			
<b>Data source:</b> official timber grade rules and specific publications (see <a href="#">Annex 4</a> ); contributions of experts in forest management, timber grading and technology.			
<b>Implications for management:</b> <ul style="list-style-type: none"><li>• At <u>single tree level</u>: identification and marking of future crop trees and decision on the application of selective thinning or felling.</li><li>• At <u>stand level</u>: assessment of the aggregated stand quality and planning, if necessary, of specific interventions to increase this: induce regeneration, enrichment planting, pruning...</li></ul>			
<b>Categories of timber quality for a standing log:</b> The timber quality categories for a log correspond to those defined in the official ISO rules: <b>A:</b> exceptional quality: log suitable for use in veneer, fine furniture and high quality cooperage <b>B:</b> special and top quality sawnwood: furniture, cooperage, beams, turnery <b>C:</b> second and intermediate quality sawnwood: small furniture, carpentry, flooring, beams  For each of these categories <a href="#">Table 1 shows the values to be taken into account for various assessment variables. The presence of rot, cracks or insect holes in the log are incompatible with any of the categories shown. The categories with lower qualities (D: oak sleepers, pallets; E: pulp, fuelwood) have not been considered. <a href="#">Annex 2</a> shows additional species-level requirements.</a>			
<b>Table 1. Dimensional and morphological requirements of the three timber quality categories considered</b>			
<b>Variable</b>	<b>A</b>	<b>B</b>	<b>C</b>
Length (cm)	≥ 250 ≥ 120 cooperage	≥ 300 ≥ 120 cooperage ≥ 450 beams	≥ 200 ≥ 450 beams
Mean diameter over bark (cm)	≥ 40 maple ≥ 45 rest	≥ 35 maple, cherry ≥ 40 rest	≥ 30 oak ≥ 25 rest
Curvature (cm/m)	≤ 2	≤ 4	≤ 2 beams ≤ 10 rest
Ovality (D/d)	≤ 1.15	No limit	No limit
<b>Timber quality assessment at tree level.</b> The quality category of a tree can be expressed as the length of logs (rounded to 0.5 m) that can be assigned to the highest quality category possible. For instance, a tree with a 3 m long log grade A and another 2 m long log grade C could be expressed as: 3A+2C. In the case of a potential use for cooperage, it could be expressed with “b” subscript: 1,5A <sub>b</sub> +3B.			

[Figure 2](#) shows a diagram to facilitate use of this module in the field.

[Annex 1](#) provides a proposal for a field chart to record the results of this module at stand level.

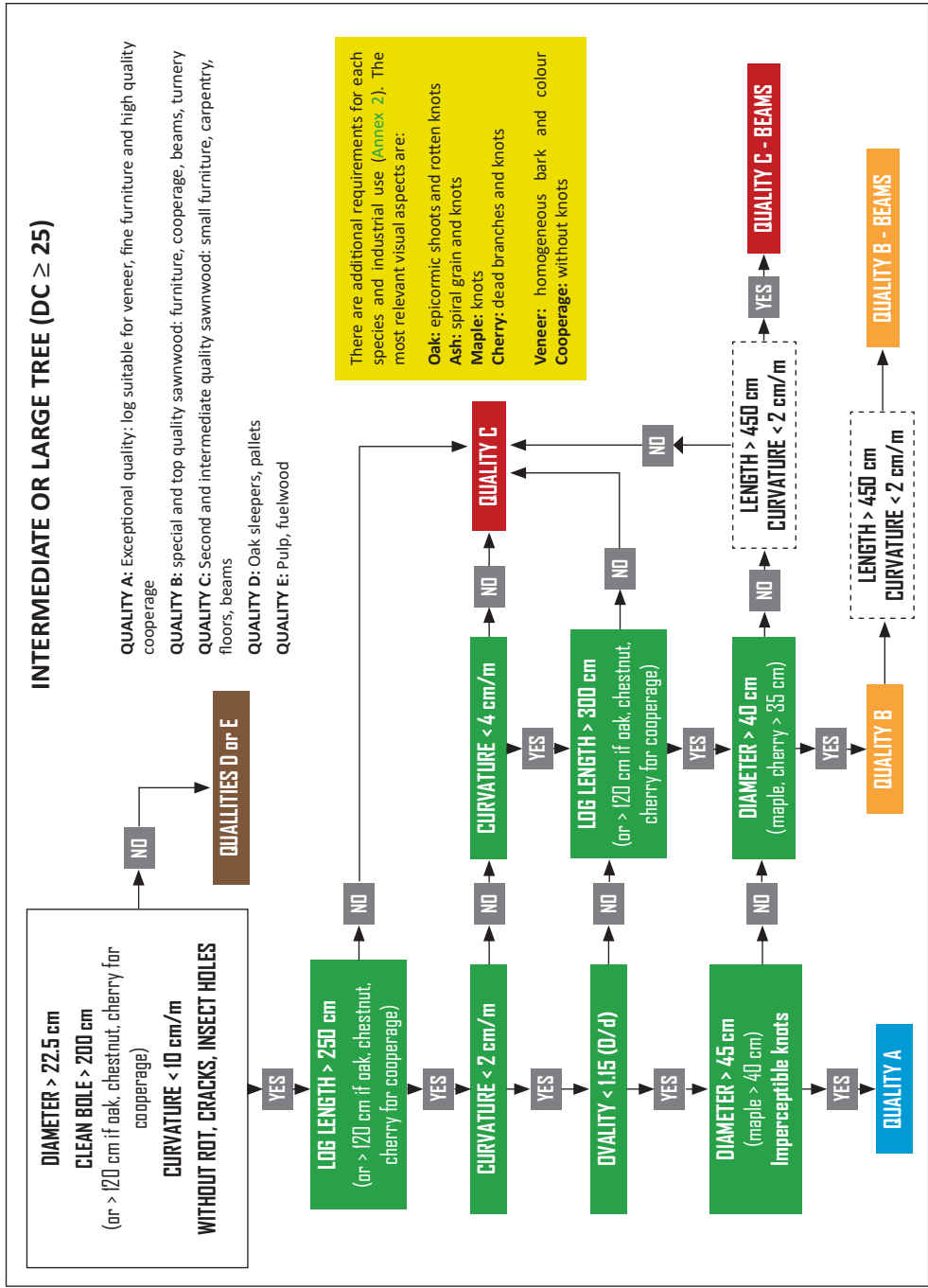


Figure 2. Diagram summarizing the timber quality assessment criteria for standing logs of intermediate or large trees (DBH > 22.5 cm)



## **ANNEX 1**

### **Examples of field charts to assess the potential and aggregated quality at stand level**

## Module 1. Assessment of the potential for timber quality production of standing small and intermediate trees (DBH 7.5-32.5 (oak)/7.5-27.5 (rest))

More columns can be added to the right if there are more than 4 species to evaluate.

<b>Stand:</b> <b>Date:</b> <b>Team:</b>	<b>Species:</b>	<b>Species:</b>	<b>Species:</b>	<b>Species:</b>
Number and percentage of trees with potential for promotion (meeting all requirements)				
# trees/ha with potential for promotion				
% trees with potential for promotion				
Predominant DBH (range)				
Predominant clean bole height (range)				
Other broadleaved species without potential trees (reason)				
Distribution of trees with potential for promotion				
Homogeneous (mark X)				
Grouped (describe sites and/or group size)				
Trees WITHOUT potential: main quality criteria which are NOT met (mark X or indicate estimated %)				
High vitality, dense crown not compressed vertically				
Absence of relevant wounds or rot				
Log (> 250 cm long), without live branches > 6 cm (oak); > 4 cm (other)				
Log with inclination $\leq 10^\circ$ and curvature < 3 cm/m (Figure 1)				
Cherry: without dead branches with $\varnothing > 3$ cm				
Mediterranean areas: ash, maple and cherry NOT located in crests or SW aspect				
Additional comments				
Other comments (applicable interventions, regeneration viability...)				

## Module 2. Assessment of standing timber quality in intermediate and large trees (DC25+)

### **OPTION 1: general stand description (less detailed description)**

More columns can be added to the right if there are more than 3 species to evaluate.

<b>Stand:</b> <b>Date:</b> <b>Team:</b>	<b>Total stand</b>	<b>Species:</b>	<b>Species:</b>	<b>Species:</b>
Number of qualified trees (at least one log grade C)				
# trees/ha with at least one A log				
# trees/ha without A logs but at least one B log				
# trees/ha without A,B logs but at least one C log				
Distribution of qualified trees				
Homogeneous (mark X)				
Grouped (describe type of sites and/or group size)				
General description of qualified trees				
Predominant DBH (range)				
Predominant clean bole height (range)				
Main defects limiting timber quality (indicate estimated percentage)				
Log length				
Curvature				
Ovality				
Rot, cracks, insect holes				
Other (describe)				
Level of urgency of the next intervention (high: 1-2 years; intermediate: 3-5 years; low: 6+ years)				
Selective thinning				
Pruning				
Other (describe)				
Additional comments				
Other comments (regeneration of a given species, dieback problems...)				

**OPTION 2: tree by tree description (more detailed)**  
*More rows can be added below.*

Stand:			Date:			Team:	
Tree code (waypoint)	Species	DBH (cm)	Bole height (m)	Potential pruning height (m)*	Optimal quality category	Pruning urgency	Selective thin- ning urgency
						(High: 1-2 years; intermediate: 3-5 years; low: 6+ years)	

\* Potential pruning height: maximum height at which pruning can be applied. The value should not be higher than 6 m (maximum pruning height with telescopic hand tools) and only the branches less than 4 cm in diameter (6 cm in the case of oak) can be considered for pruning.



## EXAMPLE OF COMPLETED FORMS

### Module 1. Tree potential, four species detected

Stand: 1A Date: 12/03/2021 Team: AA, BB	<i>Quercus petraea</i>	<i>Prunus avium</i>	<i>Castanea sativa</i>	<i>Sorbus torminalis</i>
Number and percentage of trees with potential for promotion (meeting all requirements)				
# trees/ha with potential for promotion	50	20	10	10
% trees with potential for promotion	40	30	100	50
Predominant DBH (range)	15-20	15-20	8-15	8-12
Predominant clean bole height (range)	4-5	4-6	6-8	3-4
Other broadleaved species without potential trees (reason)	<i>Sorbus domestica</i> ( $\varnothing < 7.5$ cm), <i>Pyrus communis</i> (crooked)			
Distribution of trees with potential for promotion				
Homogeneous (mark X)	X		x	x
Grouped (describe sites and/or group size)		3-4 trees/ group, valley bottom		
Trees WITHOUT potential: main quality criteria which are NOT met (mark X or indicate estimated %)				
High vitality, dense crown not compressed vertically		25	-	67
Absence of relevant wounds or rot	50	25	-	
Log (> 250 cm long) without live branches > 6 cm (oak); > 4 cm (other)	25	25	-	33
Log with inclination < 10° and curvature < 3 cm/m (Figure 1)	25		-	
Cherry: without dead branches with $\varnothing > 3$ cm			-	
Mediterranean areas: ash, maple and cherry NOT located in crests or SW aspect		25	-	
Additional comments				
Other comments (applicable interventions, regeneration viability...)		Urgent pruning	Urgent pruning	Urgent pruning; good regeneration

**OPTION 1: general stand description, with 2 species**

Stand: 1A Date: 12/03/2021 Team: AA, BB	Total stand	<i>Quercus petraea</i>	<i>Prunus avium</i>	
Number of qualified trees (at least one log grade C)				
# trees/ha with at least one A log	15	10	5	
# trees/ha without A logs but at least one B log	25	20	5	
# trees/ha without A,B log but at least one C log	20	20	0	
Distribution of qualified trees				
Homogeneous (mark X)		X		
Grouped (describe type of sites and/or group size)			2-3 trees/ group, valley bottom	
General description of qualified trees				
Predominant DBH (range)		30-45	25-35	
Predominant clean bole height (range)		6-9	5-8	
Main defects limiting timber quality (indicate estimated percentage of the most frequent ones)				
Log length		25	50	
Curvature		75		
Ovality				
Rot, cracks, insect holes				
Other (describe) dead branches > 3 cm			50	
Level of urgency of the next intervention (high: 1-2 years; intermediate: 3-5 years, low: 6+ years)				
Selective thinning	High			
Pruning	No			
Other (describe)	Sanitary thinning in chestnut; intermediate			
Additional comments				
Other comments (regeneration of a given species, dieback problems...)	Frequent presence of cherry regeneration groups, to release in 4-6 years			

**OPTION 2: tree by tree description (more detailed)**

More rows can be added below.

Stand: 1A		Date: 12/03/2021			Team: AA,BB		
Tree code (waypoint)	Species	DBH (cm)	Bole height (m)	Potential pruning height (m)*	Optimal quality category	Pruning urgency	Selective thin- ning urgency
						(High: 1-2 years; intermediate: 3-5 years; low: 6+ years)	
WP3103	<i>Q. petraea</i>	27	7	-	3A+3B	-	High
WP3104	<i>Prunus avium</i>	34	8	-	4B+4C	-	High
WP3105	<i>S. torminalis</i>	25	6	-	6B	-	High
WP3106	<i>Prunus avium</i>	23	4	6	3A	High	Intermediate

\* Potential pruning height: maximum height at which pruning can be applied. The value should not be higher than 6 m (maximum pruning height with telescopic hand tools) and only the branches with a diameter of less than 4 cm (6 cm in the case of oak) can be considered for pruning.

## **ANNEX 2**

### **Quality requirements of particular species and roundwood assessment**



The following table shows the main requirements at species level, as well as variables measured in roundwood, for each quality category.

Species	General	A	B	C
<b>Oak</b>	Dead branches over the top quality log accepted. Spiral grain is not a problem	≤ 1 epicormic shoot / 3 m Sound knots ≤ 20 mm: ≤ 1 / 3 m Without unsound or grouped knots, warts, shakes Sapwood ≤ 3 cm	Epicormics accepted Sound knots ≤ 40 mm: ≤ 1 / 1 m Sound knots ≤ 60 mm: ≤ 1 / 3 m ≤ 1 unsound knot (≤ 3 cm), grouped knots (≤ 4 cm) or wart / 2 m	Epicormics accepted Sound knots accepted ≤ 1 unsound knot (3-10 cm) or grouped knots (4-10 cm) / 2 m
<b>Ash</b>	Only the sapwood is used. Spiral grain is a problem	Without heartwood Without knots, lumps Red heartwood ≤ 1/5 Ø	Without heartwood Sound knots ≤ 60 mm: ≤ 150 mm / 3 m Without unsound knots, lumps Red heartwood ≤ 1/3 Ø Without olive colour	Heartwood ≤ 1/3 Ø Sound knots: ≤ 150 mm / 2 m Unsound knots: ≤ 80 mm / 2 m Lumps: ≤ 1 / 2 m
<b>Maple</b>	Only the sapwood is used. High risk of heartwood if Ø>40 cm (fertile sites), Ø>30 cm (poor sites) and in forked trees	Heartwood ≤ 1/5 Ø Sound knots: ≤ 150 mm / 3 m Without knots, lumps, red heartwood	Sound knots ≤ 60 mm: ≤ 150 mm / 3 m Without unsound knots, lumps, red heartwood	Sound knots: ≤ 150 mm / 2 m Unsound knots: ≤ 80 mm / 2 m Lumps: ≤ 1 / 2 m Red heartwood ≤ 1/3 Ø
<b>Cherry</b>	Without dead branches Ø>4 cm (risk of inner rot)	Without green vein, knots, red heartwood	Green vein ≤ 1/4 Ø Sound knots ≤ 60 mm: ≤ 150 mm / 3 m Without unsound knots, red heartwood	Sound knots: ≤ 150 mm / 2 m Unsound knots: ≤ 80 mm / 2 m Red heartwood ≤ 1/3 Ø
<b>Chestnut</b>	Without shakes. Seedlings should be prioritised over sprouts	-	-	-
Variables measurable in roundwood				
Heart eccentricity (%)		≤ 10	≤ 20	No limit
Heart crack (% Ø)		≤ 20 oak ≤ 33 rest	≤ 33 oak ≤ 50 rest	≤ 66 oak No limit rest
Diameter growth rate (mm/year)		≤ 4 oak No limit rest	No limit	No limit

Finally, some industrial destinations have further specific requirements:

- **Veneer:** regular and intact bark, regular growth rate, uniform colour, imperceptible knots.





- **Cooperage:** without knots in the heartwood; without unsound knots; sapwood < 15% diameter, annual diameter growth ≤ 3 mm/year (ideally, ≤ 1.5 mm/year); timber without defects affecting its chemical properties.








## ANNEX 3





### Species identification


This annex facilitates identification, of the principal species of this protocol, based on the main morphological traits. These species are deciduous broadleaves which may be hard to identify during the period in which they are leafless (coinciding with the period of implementation of silvicultural interventions) or when the crowns are high. In addition, these morphological traits vary over time, particularly with regard to bark appearance.

# OAKS (*Quercus canariensis* Willd./*Q. pubescens* Willd./*Q. petraea* (Matt.) Liebl.)

Young		Adult	
Slender appearance, thin crown. Vertically cracked bark, brown-greyish		Robust appearance, thick crown. Bark deeply and vertically cracked, brown	
General appearance	Bark	General appearance	Bark
			





Spring	Summer	Autumn	Winter
Flowers	Leaves	Fruits	Buds
Male: yellow aments in hanging groups	Simple, oval or elliptic shape with rounded lobed edge	Elliptic acorn, green to brown (ripen)	Conic, oval-shaped, brown reddish pubescent flakes
	 <p>Example diversity leaves <i>Q. pubescens</i></p>		
 <p><i>Q. canariensis</i></p>	 <p><i>Q. humilis</i></p>	 <p><i>Q. petraea</i></p>	







ASHES ( <i>Fraxinus excelsior</i> L., <i>Fraxinus angustifolia</i> Vahl and their hybrids)			
Young		Adult	
Straight, few branches, green greyish bark		Straight, globe shaped crown. Bark slightly cracked vertically, brown-grey	
General appearance	Bark	General appearance	Bark
			




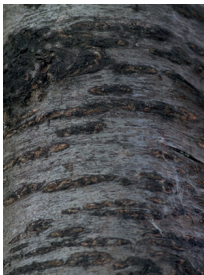
Spring	Summer	Autumn	Winter
Flowers	Leaves	Fruits	Buds
In the buds of the previous year branches, reddish or purple	Composed, 7-13 oval-lanceolate leaflets, serrated edge	Oval-oblong grouped samaras	Conical terminal bud, globe-shaped secondary buds. Dark.
	 <i>F. angustifolia</i>		 <i>F. angustifolia</i>
	 <i>F. excelsior</i>		 <i>F. excelsior</i>











## MAPLES (*Acer pseudoplatanus* L., *Acer opalus* Mill., *Acer campestre* L.)





Young		Adult	
Thin crown. Greyish or brown, slightly cracked bark		Thick crown. Greyish or brown, progressively more cracked bark	
General appearance	Bark	General appearance	Bark
			

Spring	Summer	Autumn	Winter
Flowers	Leaves	Fruits	Buds
Blossom before leaf flushing. Green, bell-shaped, hanging groups	Divided in 3 to 5 leaflets, slightly serrated edge	Glabrous, in acute or right angle	Brown, small, elliptic, glabrous
	 <i>A. pseudoplatanus</i>		
 <i>A. campestre</i>		 <i>A. opalus</i>	

CHERRY ( <i>Prunus avium</i> L.)			
Young		Adult	
Thin crown. Grey-red, smooth bark, with small oblong lenticels displayed horizontally		Slender shape, globous crown. Grey bark, cracked horizontally, with small oblong brown-reddish lenticels horizontally displayed	
General appearance	Bark	General appearance	Bark
			

Spring	Summer	Autumn	Winter
Flowers	Leaves	Fruits	Buds
White, small, hanging groups	Oblong, elliptic, serrated edge. With two small red glands in the petiole	Cherry, red to purple colour	Brown reddish, glabrous, grouped at the branch tip
			

CHESTNUT ( <i>Castanea sativa</i> Mill.)			
Young		Adult	
Straight; green to gray soft bark, white spots		Straight and robust, brown-gray vertically cracked bark	
General appearance	Bark	General appearance	Bark
			

Spring	Summer	Autumn	Winter
Flowers	Leaves	Fruits	Buds
Male: grouped in yellow aments, long and thin	Long, lanceolate, serrated edge	Chestnut, covered by a thorny shell	Brown reddish, conical shape
			

## **ANNEX 4**

### **References**

## Official rules:

- EN 1316-1:2012 *Hardwood round timber - Qualitative classification - Part 1: oak and beech.*
- EN 1316-3:1998 *Hardwood round timber. Qualitative classification. Part 3: ash and maples and sycamore.*
- EN 1309-3:2018 *Round and sawn timber - Methods of measurements - Part 3: Features and biological degradations.*
- UNE 56546:2013 *Visual grading for structural sawn timber. Hardwood timber.*

## Publications:

Alderman D, Brinderg D, Wiedenbeck J. (2010). *Forestry Practices and Veneer log Value—Manufacturer's Assessments of Veneer Log Attributes*. Forest Science 56(2): 193-200.

Alderman D, Brinderg D, Goodykoontz R.O. (2017). *Assessing Veneer Log Quality Attributes*. Proceedings of the 15th Central Hardwood Forest Conference: 435-442.

Berti S, Brunetti M, Crivellaro A, Palanti S. (2005).. *Principali caratteristiche tecnologiche del legno di ciliegio*. A: Ducci F. (coord.): Monografia sul ciliegio selvatico (*Prunus avium* L.), 114-117.

Cassens, D.L. (2004). *Factors determining the suitability of trees and logs for the face veneer industry*. Proceedings of the 14th Central Hardwood Forest Conference: 130-139.

Coello J., Piqué M., Beltrán M, Vericat P. (2013). *Recomendaciones y modelos de gestión forestal para masas mixtas de castaño y cerezo: promoción del cerezo para la producción de madera de calidad*. A: Sociedad Española de Ciencias Forestales. Actas del 6º Congreso Forestal Español.

Correal E, Rabascall X, Cervera T, Baiges T. (2017). *Guia dels criteris de classificació de la fusta en peu de Catalunya*. Generalitat de Catalunya. Departament d'Agricultura, Ramaderia, Pesca i Alimentació - Centre de la Propietat Forestal. 39 p.

Jourez B, de Wouters P, Bienfait O. (2010). *Le classement des bois feuillus sur pied*. Sylviculture — fiche technique n° 18 bonnes pratiques sylvicoles.

Kadunc, A. (2007). *Factors influencing the formation of heartwood discolouration in sycamore* (*Acer pseudoplatanus* L.). Eur J Forest Res (2007) 126: 349-358.

Mundet R, Capó J. (2007) *Guia per a la classificació de la fusta en peu. Aplicacions in transformació de la fusta dels boscos catalans*. Consorci Forestal de Catalunya. 82 p.

Taylor A. (2010). *A Hardwood Log Grading Handbook*. University of Tennessee. 28 p.

Vericat P, Piqué M, Beltrán M, Obon B. (2013). *Opcions de gestió del castanyer i models silvícoles per al context actual*. A: VV.AA. (ed.), El castanyer a Catalunya: gestió, conservació i productes. Diputació de Barcelona. Barcelona. 144 p.

Wiedenbeck J, Wiemann M, Alderman D, Baumgras J, Luppold W. (2004). *Defining Hardwood Veneer Log Quality Attributes*. USDA Forest Service, Northeastern Research Station. General Technical Report NE-313. 40 p.