Effects of extreme storms in the Portuguese forest: assessment of damages and development of a storm catalogue (a preliminary approach)

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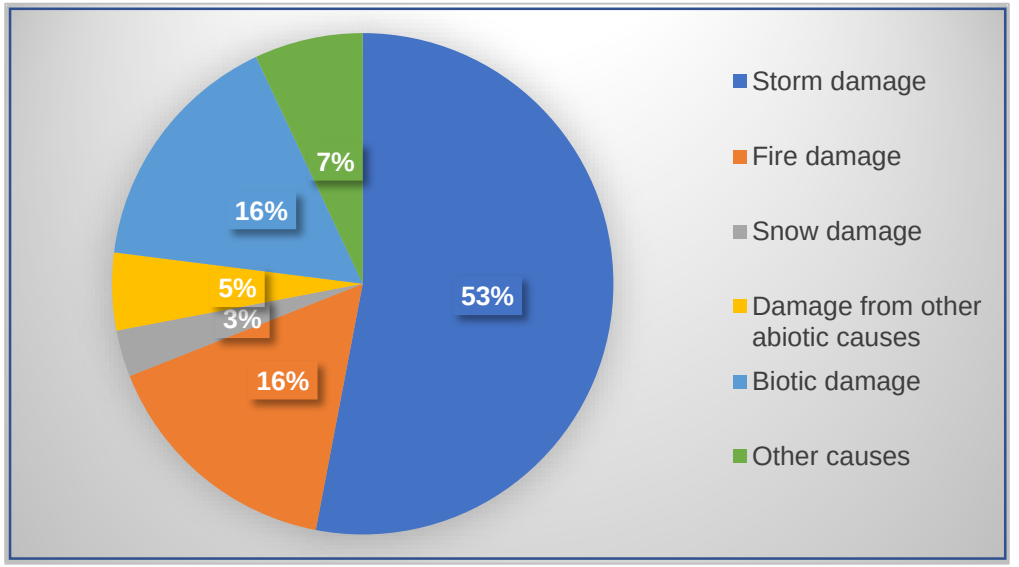
1. Effects of storms in the European forest

Storms are the most responsible abiotic causes of damage to European forests (Schelhaas *et al*., 2003).



Severe storms have caused serious disturbances and impacts on European forests. Since 1950, more than 130 storms have been identified as damaged forest areas (Gardiner *et al*., 2010), leading to a loss of 35 million m^3 of wood by 2000 (Schelhaas *et al*., 2003).

Period 1950 to 2014

Institut Européen De La Forêt Cultivée

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Forestorm

Number of matching rows : 275

see detail / storm	Event ID = Year-Number	Month-Day	Storm Name	Country	Affected Area (ha)	QA	Primary damage (Mm3)	Q1	Secondary damage (Mm3)	Q2	Tertiary damage	Q3	Estimated Growing Stock (Mm3)	QSV	calculated % of Growing Stock Damaged	Removals (Mm3)	QR	calculated % of Removals Damaged	Maximum Wind Speed (m/s)	QW	Duration of Storm (Hrs)	QD	Value (Million Euros) in Year FOREST Damage	QV	last_update
See storm	1902-01			France		1	1.20	1		1		1		1			1			1				1	2014-01-10 16:42:18
See storm	1950-01	August 23		Netherlands									16.80			0.94									2010-07-22 17:35:19
See storm	1951-01	December 30		UK			0.12	3					114.56		0.10	4.00		3.00	37	3					2010-07-22 17:35:20
See storm	1952-01	February 11		Denmark			0.36	3					40.20		0.90	2.03		17.73							2010-07-22 17:35:21
See storm	1952-02	May 4		Germany			0.06	3					1329.04		0.00	50.74		0.12							2010-07-22 17:35:23
See storm	1952-03	November 26-27		France									861.42			40.31									2010-07-22 17:35:24
See storm	1952-04	December 12-13		France			0.70	3					861.42		0.08	40.31		1.74							2010-07-22 17:35:26
See																									

(Gardiner *et al*., 2010)

Storms Database : European Forest Institute (2010)

Some of the more extreme storms in the European forest in the last decade:

- Storm Lothar and Martin (1999) – France, Germany and Switzerland
- Storm Per and Kyrill (2007) – effects in most Europe
- Storm Klaus (2009) – France, Spain and Portugal
- Storm Christian (2013) – Belgium, Denmark, Finland, France, The Netherlands, Germany and others.
- Storm Leslie (2018) – Portugal, Spain and France
- Storm Adrian (2018) – Italy, Belgium, France, The Netherlands, Spain and The United Kingdom

Storm Lothar and Martin (1999) – France, Germany, Switzerland

Effects of Storm Lothar and Martin in the Vosges forest, France (1999).

Source: Virot (s.d)

Storm Lothar and Martin (1999) in France

Volume of wood affected:

176 milion m^3

(Birot *et al*., 2009)

Storm Klaus (2009) – France, Spain, Portugal

Effects of Storm Klaus in the Landes forest, Rion-des-Landes, France (2009). Source: Lafon, 2018

Storm Klaus (2009) in France

Volume of wood affected:

40 milion m^3

(forest of Landes de Gascogne)

(Lafon, 2018)

Storm Leslie (2018) – France, Spain, Portugal

Storm Leslie (2018) in Portugal

Effects of Storm Leslie in Figueira da Foz, Portugal (2018). Source: Cordeiro, 2018

Storm Adrian (2018) – Italy

Storm Adrian in Veneto, Italy (2018). Source: Donati, 2018

Area affected:

50 000 ha

14 milion Pinus and red spruces trees affected

(Donati, 2018)

1.1 Effects of storms in the Portuguese forest

Some of the more extreme storms:

- Storm of 1941
- Storm Gong (2013)
- Storm Ana (2017)
- Storm Leslie (2018)

Storm of 1941 in Portugal

Impacts of Storm of 1941 in Maritime Pine stands of Leiria, Portugal.

One of the most severe and violent storms since there are records in the Portuguese territory (Nunes *et al*., 2011).

hundreds of thousands of trees affected at national level

(Nunes *et al*., 2011)

Storm Gong (2013) in Portugal

- **In the unit of Baldio da Paraduça:**
  974 *Pinus pinaster* trees affected (766.21 m^3)
  50/60% of the total existing stock

Intervention of forest saplers in the communitary unit of Paraduça after the storm Gong (2013) Source: (ICNF, 2013)

(ICNF, 2013)

- **In Perimeter of Entre Lima and Neiva:**
  700 trees affected in an area of 3 ha

- **In Perimeter of Entre Vez and Coura:**
  234 trees affected in an area of 2 ha

Storm Ana (2017) in Portugal

Damage to *Pinus sylvestris* stands due to storm Ana (2017) in Ribeira de Pena, Vila Real (Photos provided of Avelino Rego).

Storm Ana (2017) in Portugal

Damage to *Pinus pinaster* stands due to storm Ana (2017) in Alvão Natural Park, Vila Real District (Photos provided of Avelino Rego).

Storm Leslie (2018) in Portugal

Damage caused by the storm Leslie (2018) in Figueira da Foz

2. The WEX-Atlantic project

Objectives:

- obtain information to prepare a catalogue of storms and the damage caused by the wind in Portugal
- development of a storm catalogue in Portugal.

The information that will be gathered will provide valuable support for discussion concerning to adaptive forest management and optimal climate change mitigation strategies and to assist post-storm procedures.

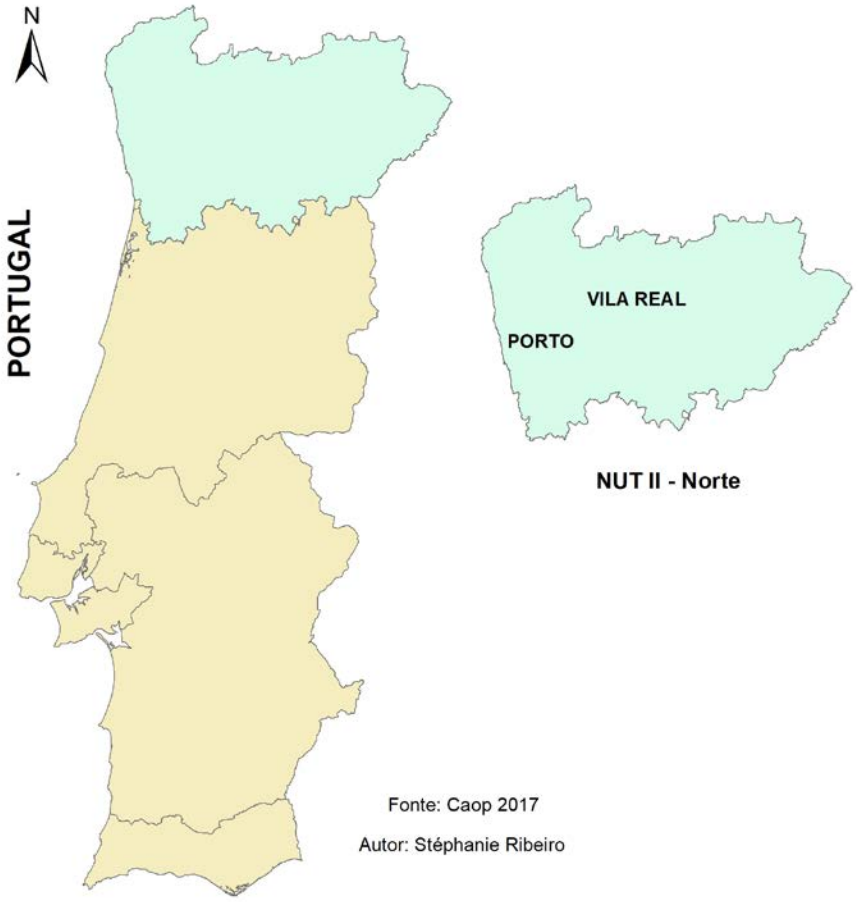
2. The WEX-Atlantic project

The study area:

- The major extreme events of wind and snow recorded during the period in forest areas in the North and Centre of Portugal.

The period of the study:

- Last 30 years (or 10 years)



2. The WEX-Atlantic project

- Methodology

The causes of salvage harvests will be verified by crossing the date of the record with the date of the meteorological events

Search and gather information

severe storms that have affected PF and their effects

ICNF
Instituto da Conservação da Natureza e das Florestas

Collection of information in the ICNF

(Porto, Coimbra)

Creation of a database prototype

newspapers and other relevant documentation available online through web search engines

2.1 Assessment of damages in Portugal

The information on the damage caused by storms in the Portuguese forest is not easy to access and is scarce.

Information available in the **Storms Database** on the storms and their damages in the Portuguese forest.

Number of matching rows : 275

see detail / storm	Event ID = Year-Number	Month-Day	Storm Name	Country	Affected Area (ha)	QA	Primary damage (Mm3)
Storm Lothar and Martin (1999)							
See storm	1999-04	December	Lothar/Martin	Portugal			0.00
See storm	2010-01	February 28	Xynthia	Portugal	**Storm Xynthia (2010)**		

Collection of information in the ICNF

ICNF
Instituto da Conservação da Natureza e das Florestas

DEPARTAMENTO DE CONSERVAÇÃO DA NATUREZA E FLORESTAS DO NORTE

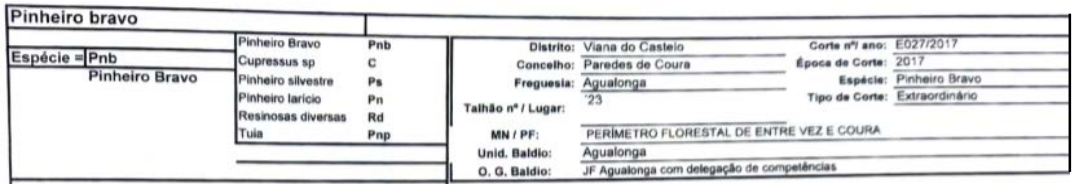
DISTRITO VIANA DO CASTELO

CONCELHO PAREDES DE COURA

CORTE EXTRAORDINÁRIO N.º 027 a realizar por superfície em 2017

PERÍMETRO FLORESTAL DE ENTRE VEZ E COURA

AUTO DE MARCA



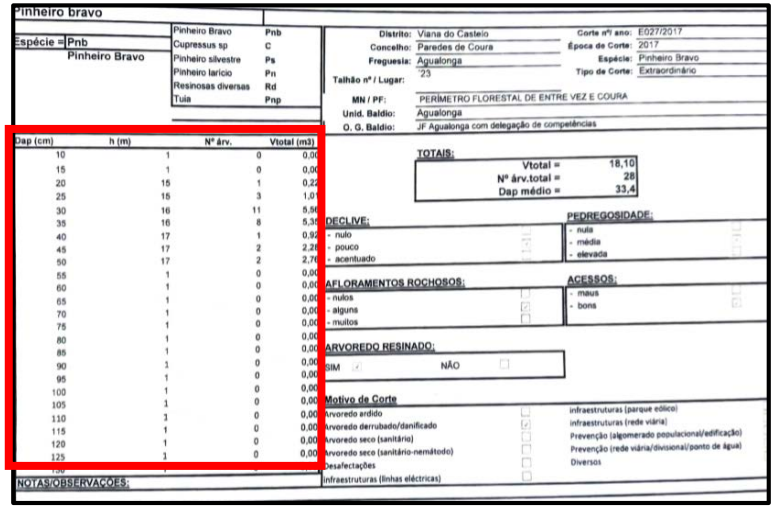
Pinheiro bravo

Espécie = Pnb
Pinheiro Bravo

Pinheiro Bravo	Pnb
Cupressus sp	C
Pinheiro silvestre	Ps
Pinheiro larício	Pn
Resinosas diversas	Rd
Tuia	Pnp

Distrito:	Viana do Castelo	Corte nº/ ano:	E027/2017
Concelho:	Paredes de Coura	Época de Corte:	2017
Freguesia:	Agualonga	Espécie:	Pinheiro Bravo
Talhão nº / Lugar:	'23	Tipo de Corte:	Extraordinário
MN / PF:	PERÍMETRO FLORESTAL DE ENTRE VEZ E COURA		
Unid. Baldio:	Agualonga		
O. G. Baldio:	JF Agualonga com delegação de competências		

Identification of the species, district, county, parish, number of cut, year of cut, type of cut, plot or place, national forest or forest perimeter, waste unit and waste management organ.



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Talhão nº / Lugar:	23	Tipo de Corte:	Extraordinário
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Unid. Baldio:	Agualonga		
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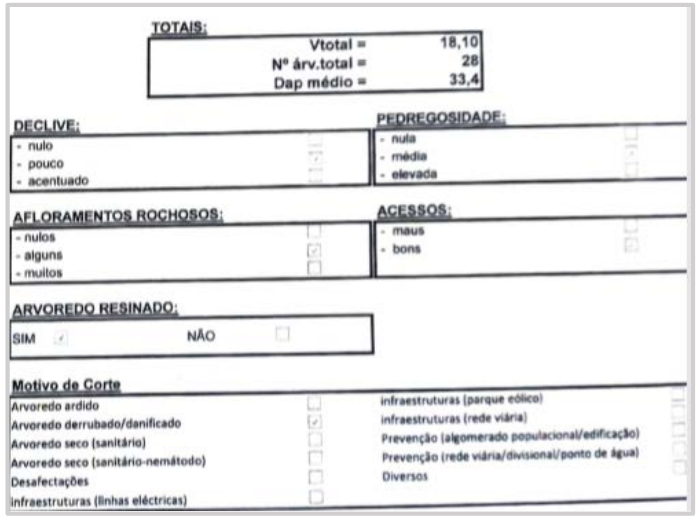
Dap (cm)	h (m)	Nº árv.	Vtotal (m3)
10	1	0	0,00
15	1	0	0,00
20	15	1	0,22
25	15	3	1,01
30	16	11	5,56
35	16	8	5,35
40	17	1	0,92
45	17	2	2,28
50	17	2	2,76
55	1	0	0,00
60	1	0	0,00
65	1	0	0,00
70	1	0	0,00
75	1	0	0,00
80	1	0	0,00
85	1	0	0,00
90	1	0	0,00
95	1	0	0,00
100	1	0	0,00
105	1	0	0,00
110	1	0	0,00
115	1	0	0,00
120	1	0	0,00
125	1	0	0,00
130	1	0	0,00

Distribution of trees per diameter classes



TOTAIS:

Vtotal =	18,10
Nº árv.total =	28
Dap médio =	33,4

DECLIVE:
- nulo
- pouco
- acentuado

PEDREGOSIDADE:
- nula
- média
- elevada

AFLORAMENTOS ROCHOSOS:
- nulos
- alguns
- muitos

ACESSOS:
- maus
- bons

ARVOREDO RESINADO:
SIM NÃO

Motivo de Corte
- Arvoredo ardido
- Arvoredo derrubado/danificado
- Arvoredo seco (sanitário)
- Arvoredo seco (sanitário-nemátodo)
- Desafectações
- infraestruturas (linhas eléctricas)
- infraestruturas (parque eólico)
- infraestruturas (rede viária)
- Prevenção (algomerado populacional/edificação)
- Prevenção (rede viária/divisional/ponto de água)
- Diversos

Reason for cutting: knocked over / damaged

2.2 Development of a storm catalogue

Orgão de Gestão (baldio)	corte nº/ano	Talhão nº /Lugar	Essência(s)	Volume (m^3)	Nº de árvores	Dap médio (cm)	Área afetada (ha)	Valor (€)		Nº árv.	Área Total do lote (ha)	Volume (m^3)	Valor obtido do lote (€) s/IVA
	E44/2017	15	Acácia austrália	6,35	7	34,3	a			1 397	16,99	763,73	18 500
	E39/2017	11	Acácia austrália	9,59	11	35,5	a			1 397	16,99	763,73	18 500
	E36/2017	11	Pinheiro-bravo	8,25	13	32,7	a			1 397	16,99	763,73	18 500
	E29/2017	11	Chamaeciparis	1,18	1	45	a			1 397	16,99	763,73	18 500
	E27/2017	11	Cupressus sp	3,42	5	37	a			1 397	16,99	763,73	18 500

Catalogue of storms in the Portuguese forest

Under development…

Thank you for your attention!

Merci pour votre attention!

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This presentation was prepared under the umbrella of the WEx-Atlantic Project: Meteorological extremes in the Euro-Atlantic region: evaluation and impacts