

Exploitation And Realisation of Thinnings from Hardwoods E.A.R.T.H.



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Project funded by the Department of Agriculture, Food and Marine under the DAFM research funding program. Project reference 15C666



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<http://www.nuigalway.ie/terg/>

E.A.R.T.H. project information

- E.A.R.T.H.: 2 years project (till 28/02/2019) funded by DAFM
- Project team:
 - Annette M. Harte (Project Coordinator, NUIG)
 - Ian Short (Forestry researcher, TEAGASC)
 - Daniel F. Llana (Post-doct, NUIG)
- Industrial Partners → ECC Teoranta / Lonza & WMF
- Other collaborations → ITGA / GMIT Letterfrack
- Project planning:
 - Preliminary evaluation (till May 2018)
 - Final evaluation (till February 2019)



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Introduction Daniel F. Llana

- 2007 B.Sc. Agronomy Engineering (ULE)
- 2008-2009 Steel construction sector
- 2010 M.Sc. Rural construction (UPM)
- 2016 Ph.D. Timber grading by NDT (UPM)
- 2016-2017 Post-doc Assessment of existing timber structures (UPM)
- 2017-2019 Post-doc Irish hardwood thinnings E.A.R.T.H. (NUIG)



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Timber Engineering Research Group (TERG)

National University of Ireland Galway

- Established 2004
- Team:
 - Prof. Annette M. Harte
 - 4 Post-Docs + 7 Ph.D. students
- Research lines:
 - Engineered wood products
 - Timber structural connections
 - Reinforcement of timber structures
 - Characterization of timber properties
 - Nondestructive testing (NDT) for timber grading



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Introduction Ian Short

- 1999 B.Sc. Agroforestry (UWB)
- 2001 M.Sc. Farm Forestry – Agroforestry for Development (WIT)
- 2006 Ph.D. A Novel Silvopastoral System in Lowland Ireland (QUB)
- 1999 – 2001 Research Assistant – EU-funded PAMUCEAF project, WIT
- 1999 – 2006 P/T lecturer, Forestry Diploma, WIT
- 2006 – 2009 Teagasc Broadleaf Silviculture Research Officer (contract)
- 2009 – 2010 UCD Broadleaf Silviculture Postdoc Researcher (contract)
- 2010 – present Teagasc Broadleaf Silviculture Researcher



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Introduction Ian Short

- Research interests: Broadleaf forestry; Silviculture; Agroforestry; Knowledge Transfer
- Current projects
 - Broadleaf Silviculture
 - Ash restocking
 - Transformation of SS to Continuous Cover Forestry
 - Short Rotation Forestry
 - E.A.R.T.H.



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TEAGASC

Forestry Development Dept.

- Teagasc – the Agriculture and Food Development Authority – is the national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities.
- Forestry Development Dept.
 - 8 advisors (countrywide);
 - 2 lecturers (Ballyhaise College, Co. Cavan);
 - 5 researchers (Ashtown; Athenry); 2 technical; 1 lab assistant;
 - 1 Specialist; 1 HoD; 1 Admin;
 - Postgrads



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TEAGASC

Forestry Development Dept.



Two-way
exchange of
information

Two-way
exchange of
information



RESEARCHER



ADVISORS

Two-way
exchange of
information



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YouTube video

<https://youtu.be/skhl2nu32Ko>



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Plantation-based forestry

State of Europe's Forests
2015

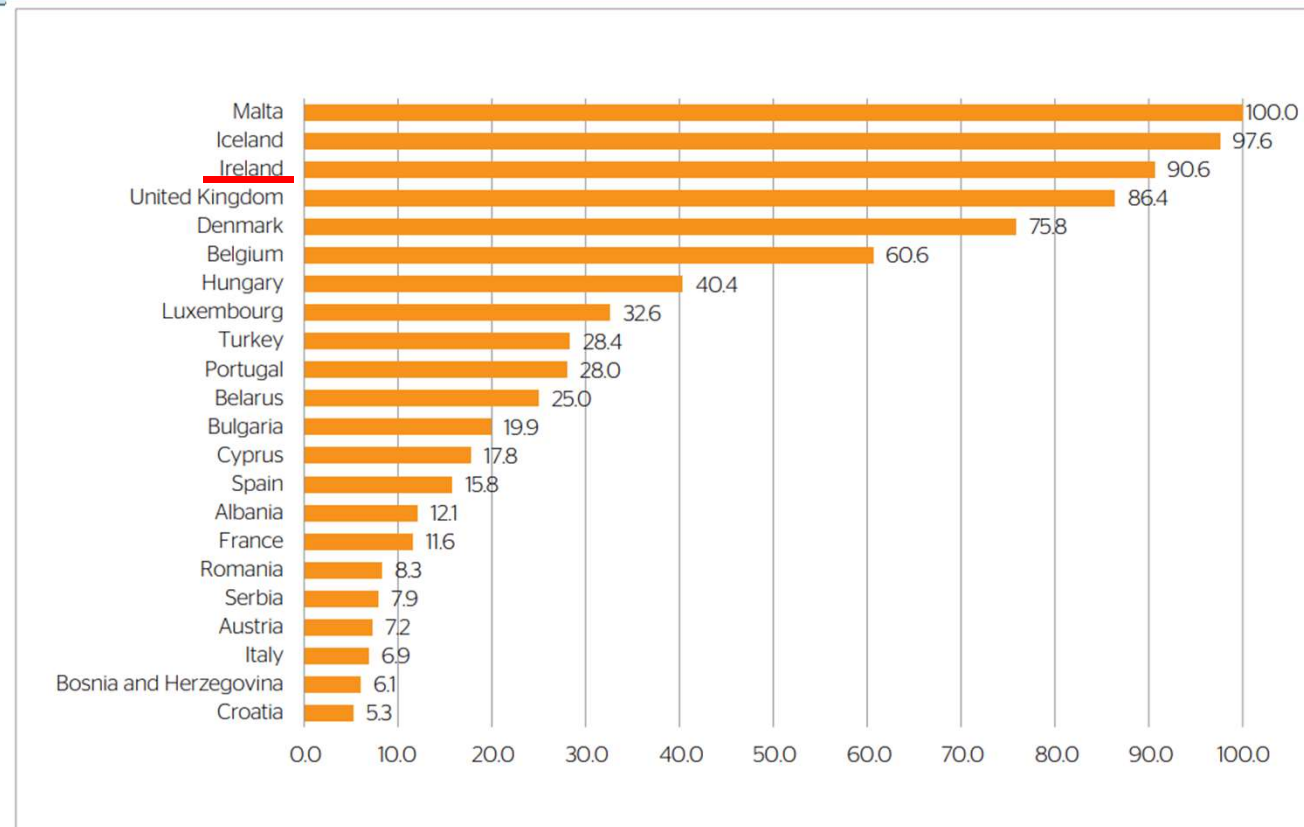


Figure 65. European countries with a share of plantations greater than 5% of the total forest area, 2015 (based on the available data)



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Conifer/broadleaf afforestation

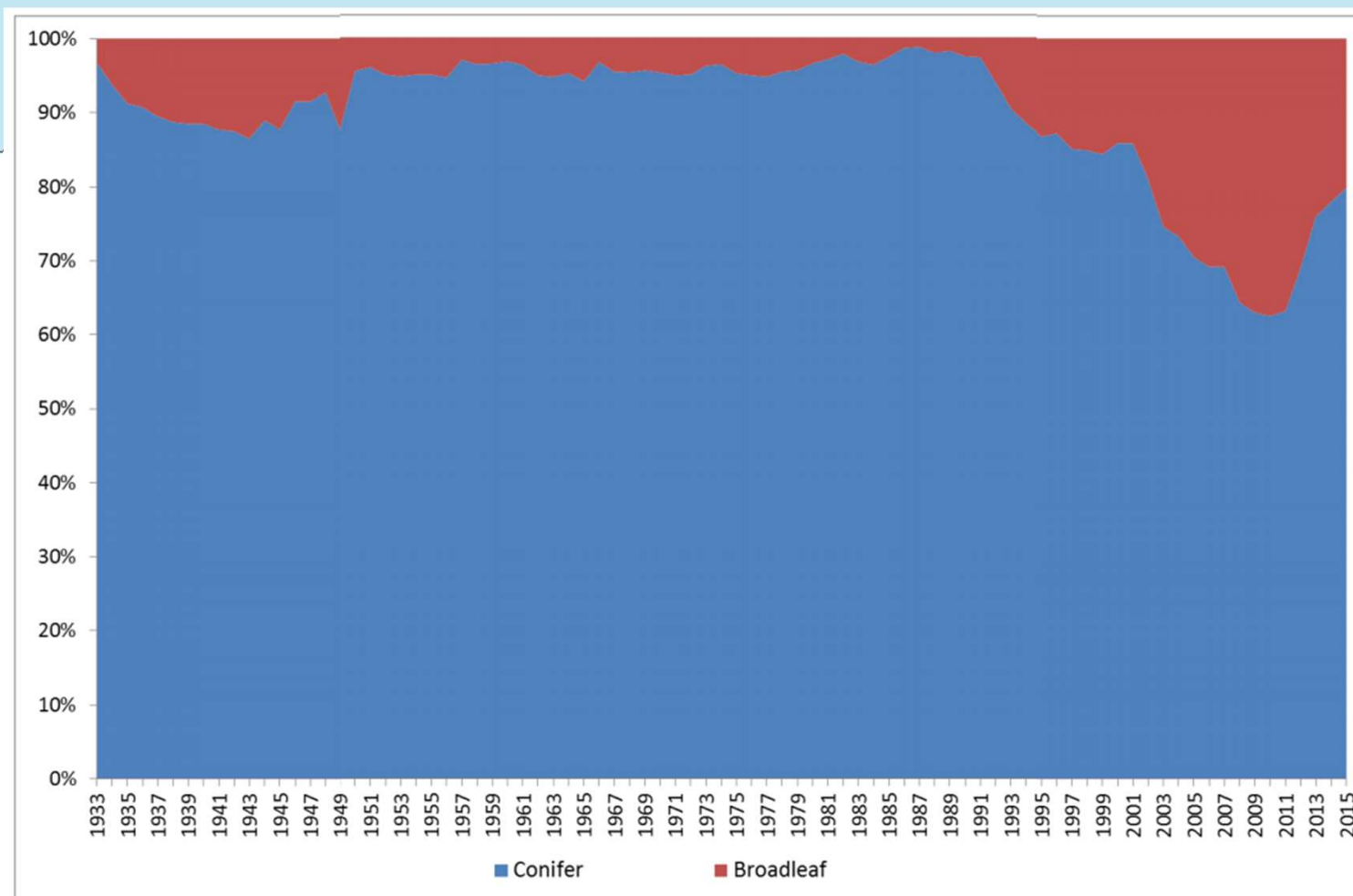


Figure 6. Conifer - broadleaf afforestation 1933-2015.



Species

Chalara ash dieback
(*Hymenoscyphus fraxineus*)

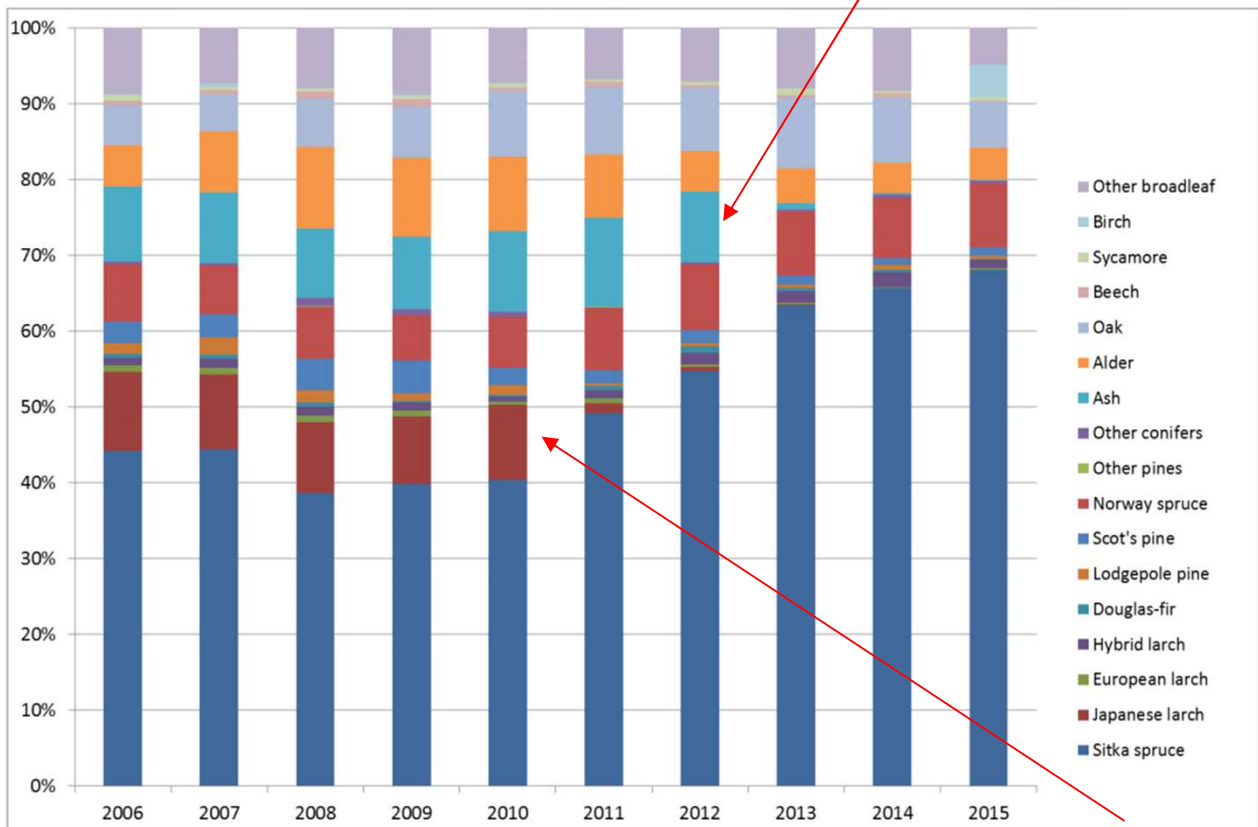


Figure 8. Grant-aided species groups, 2006-2015.

Phytophthora ramorum of larch



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Forest owner age profile

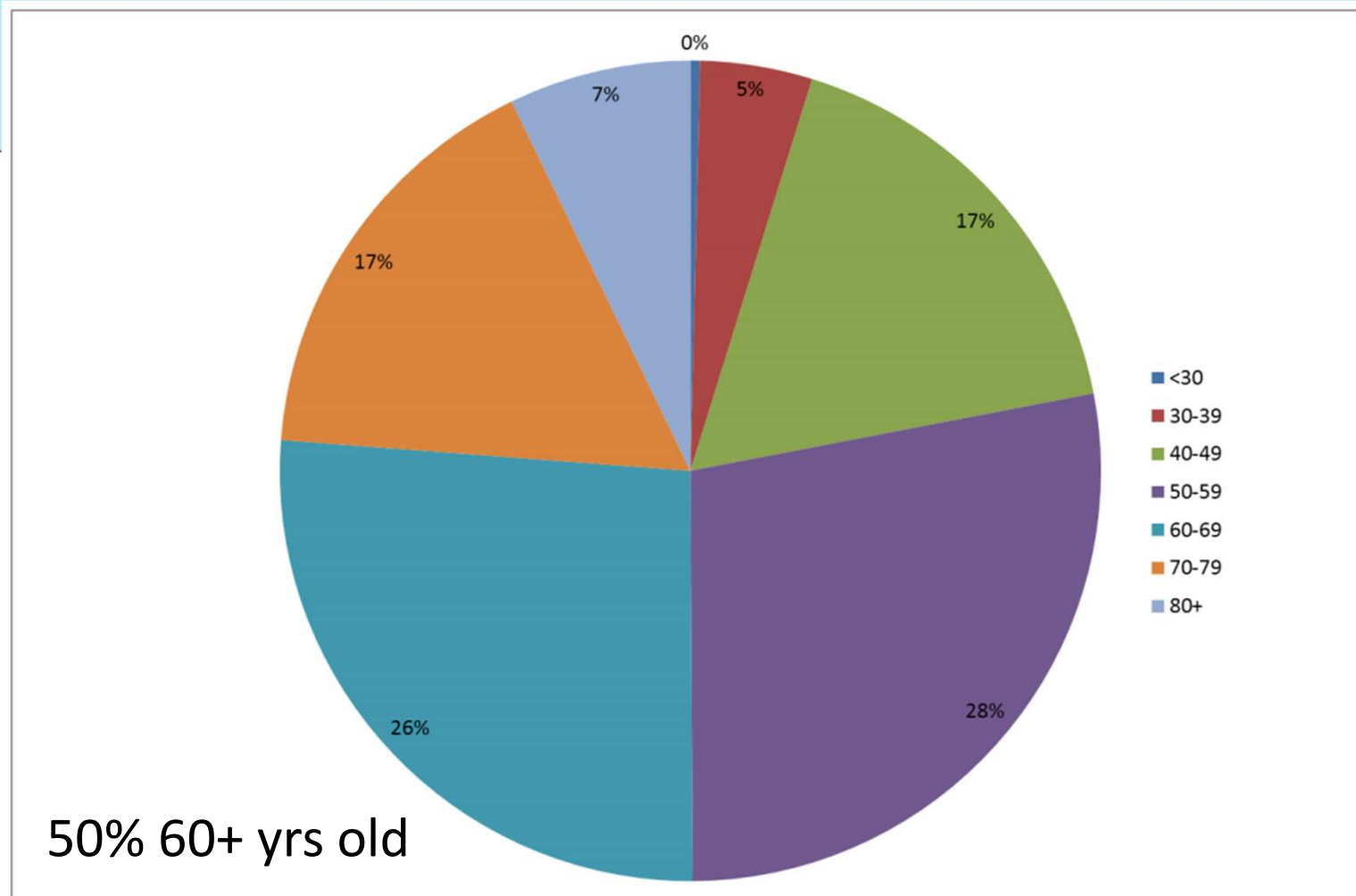


Figure 17. Age profile of forest premium recipients in 2015 (% of total area receiving premium).



Broadleaf estate - NFI

- Broadleaves = 26% of forest estate

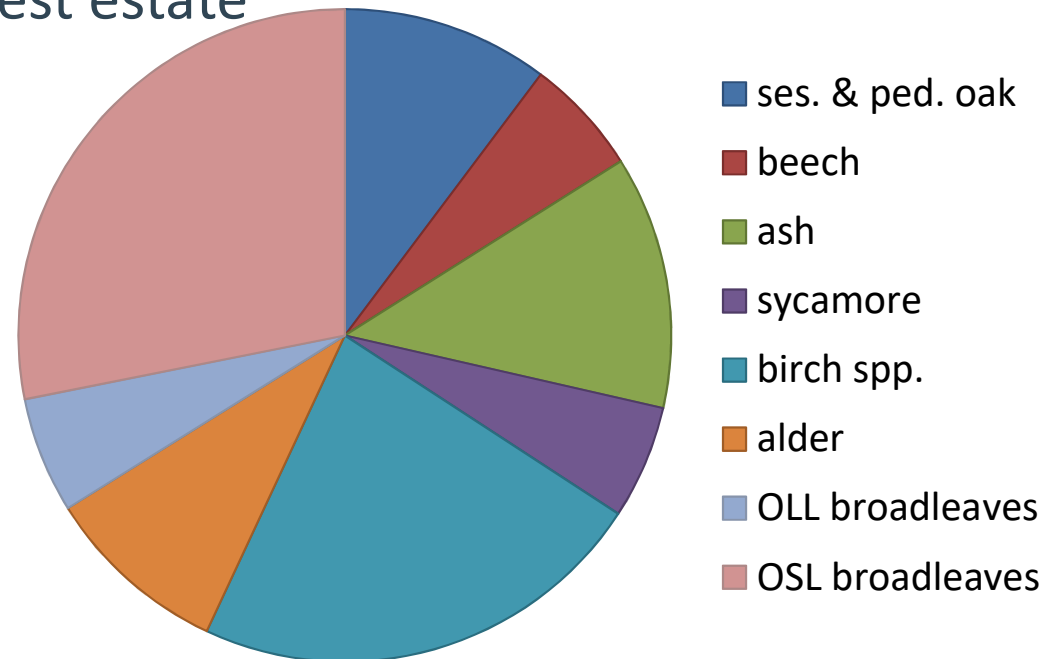
- Ash = 12.5%

- Oak = 10%

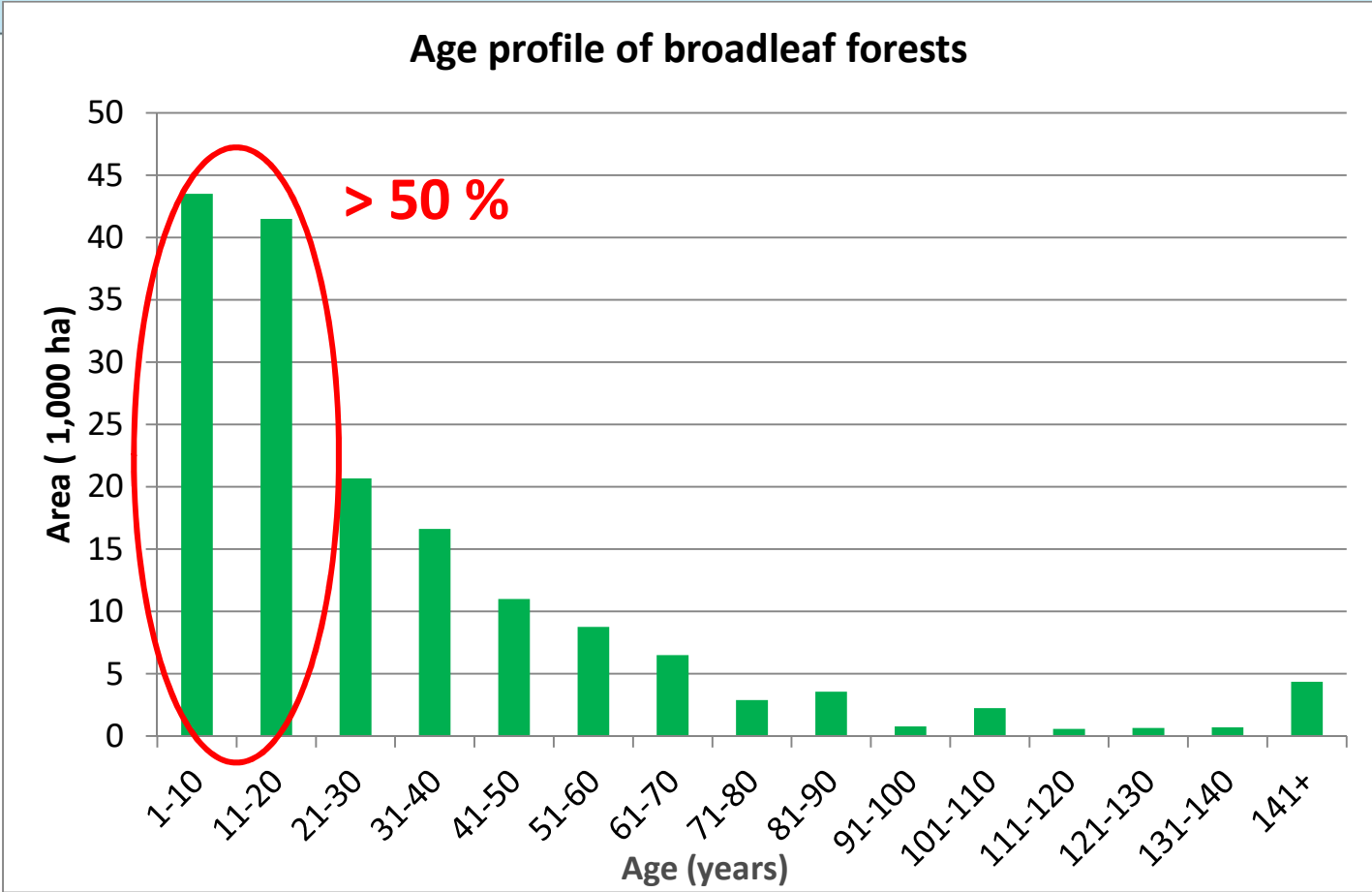
- Beech = 6%

- Sycamore = 5.5%

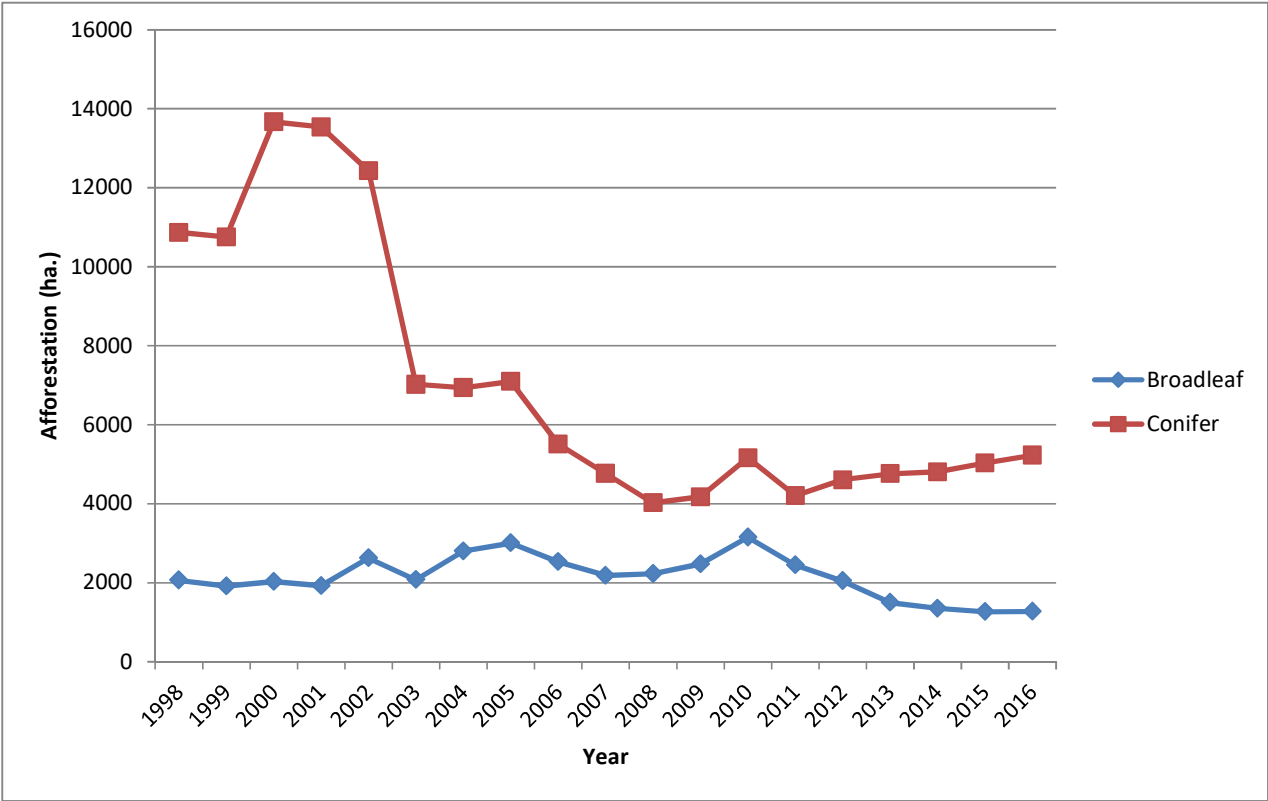
- Alder + birch = > 30% of broadleaves



Age profile



Afforestation



Establishment Grant Rates (€/ha)

Grant/Premium Category (GPC)	1st Grant (€/ha)	2nd Grant (€/ha)	Additional Fencing Allocation (IS436)	Alternative Fencing Allocation (Non IS436)	Total Available Funding (€/ha)
GPC 1 - Unenclosed	1575	525	500	350	2600
GPC 2 - Sitka spruce / lodgepole pine	2310	735	500	350	3545
GPC 3 - 10% Diverse	2360	790	500	350	3650
GPC 4 - Diverse	2625	840	500	350	3965
GPC 5 - Broadleaves	3780	1155	500	450	5435
GPC 6 - Oak	3990	1260	500	450	5750
GPC 7 - Beech	3990	1260	500	450	5750
GPC 8 - Alder	2250	840	500	450	3860



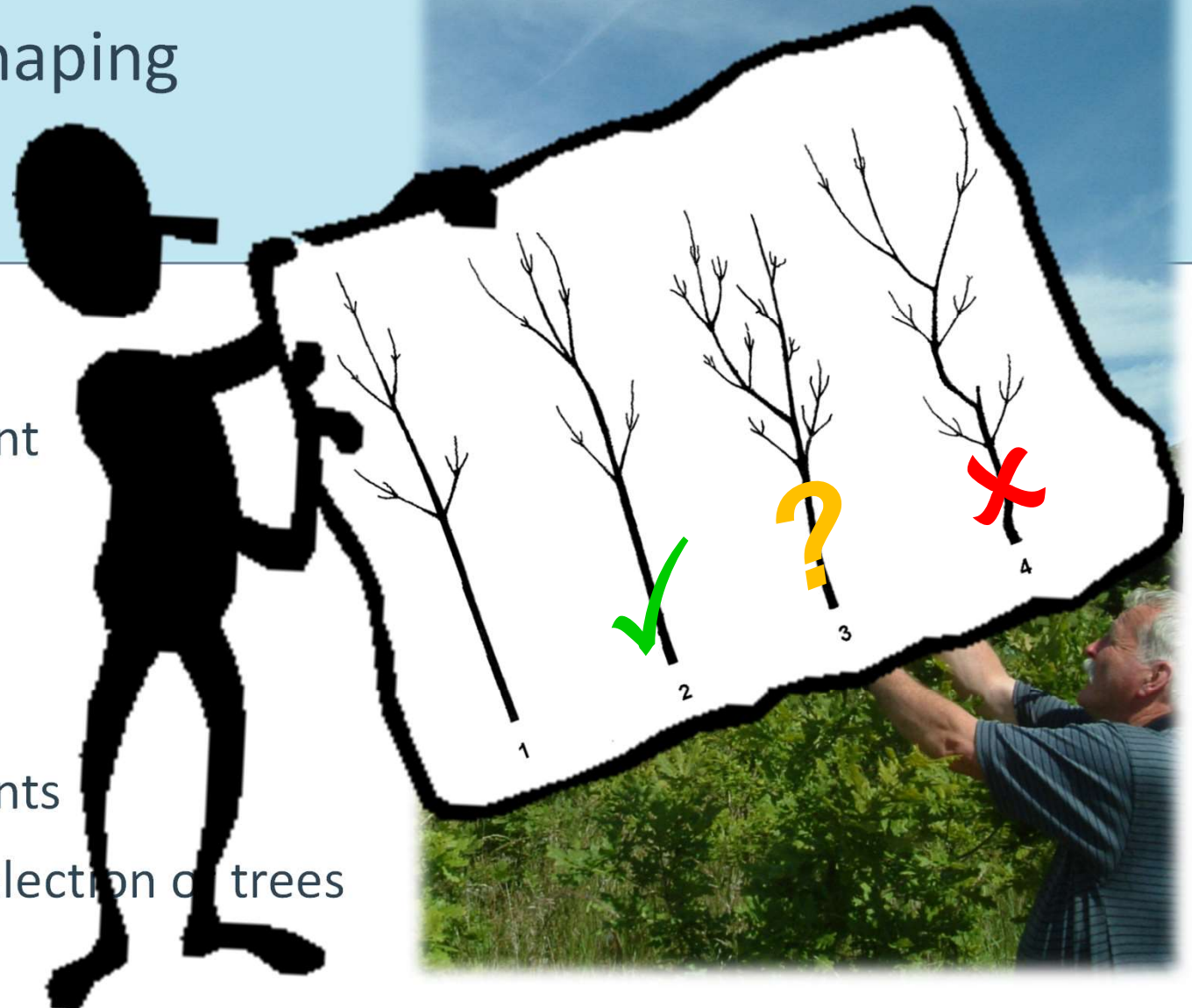
Establishment Premium Rates (€/ha)

Grant/Premium Category (GPC)	Annual premium (€/ha)	Duration (years)
GPC 1 - Unenclosed	185	15
GPC 2 - Sitka spruce / lodgepole pine	440	15
GPC 3 - 10% Diverse	510	15
GPC 4 - Diverse	560	15
GPC 5 - Broadleaves	575	15
GPC 6 - Oak	615	15
GPC 7 - Beech	615	15
GPC 8 - Alder	575	15



Formative shaping

- During years 2-4
- Maintenance grant
- Remove:
 - - DLBs
 - - Forks
 - - Co-dominants
- on selection of trees





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High pruning



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Oak value

French oak

- 6 m = 85%
- 6-12 m = 11%
- Crown = 4%

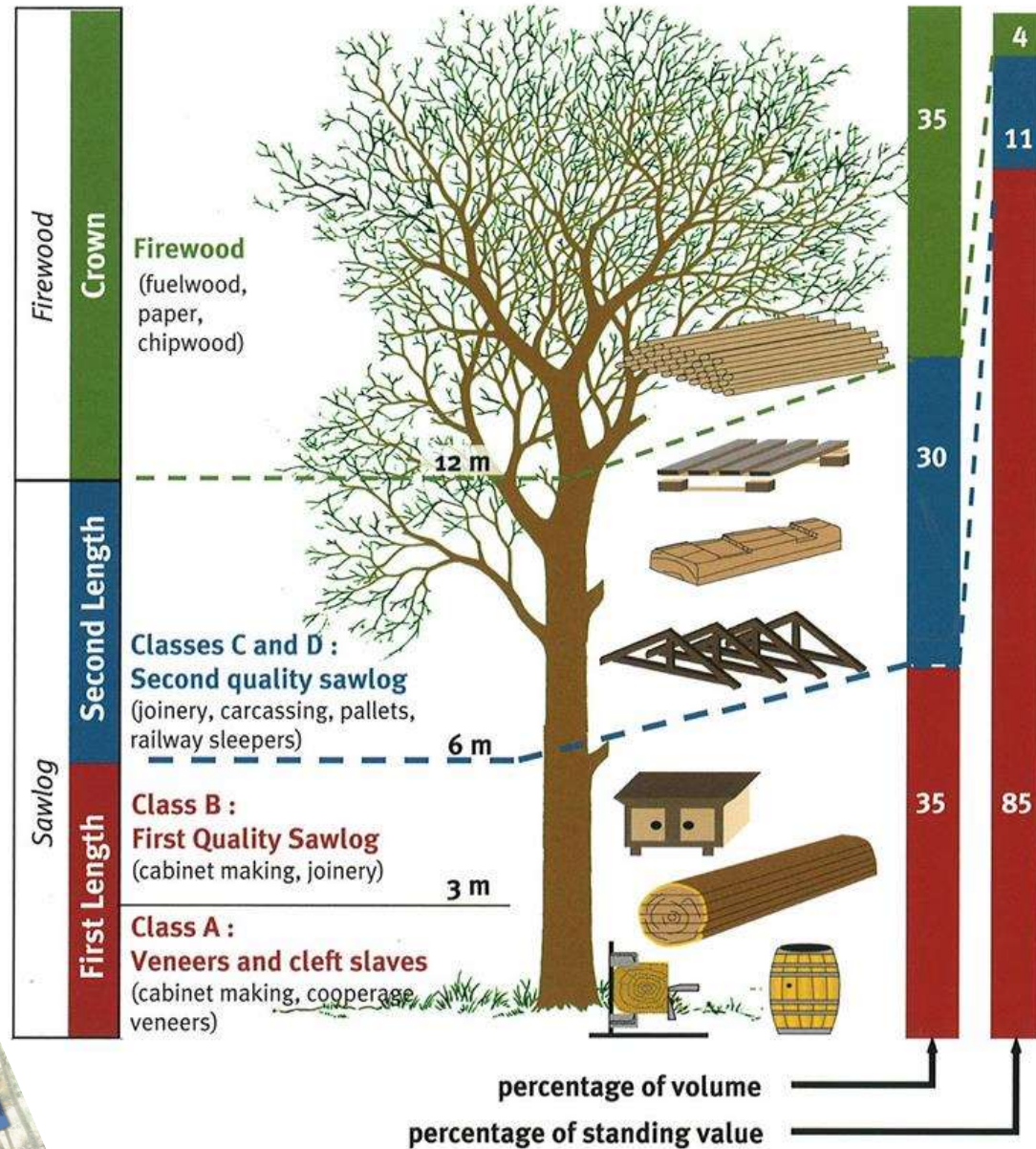
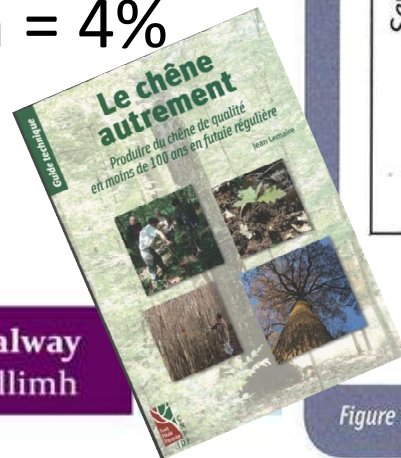


Figure 5 - Comparison of volume and value in a good quality oak sawlog



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Formative shaping / pruning



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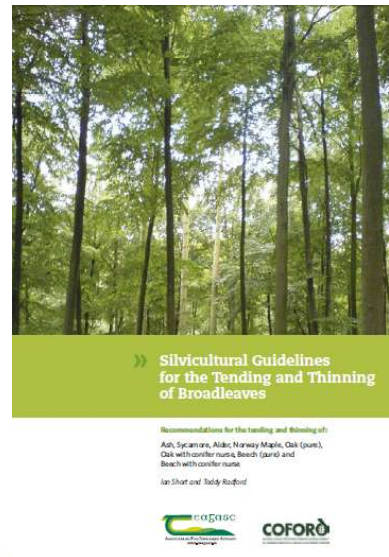


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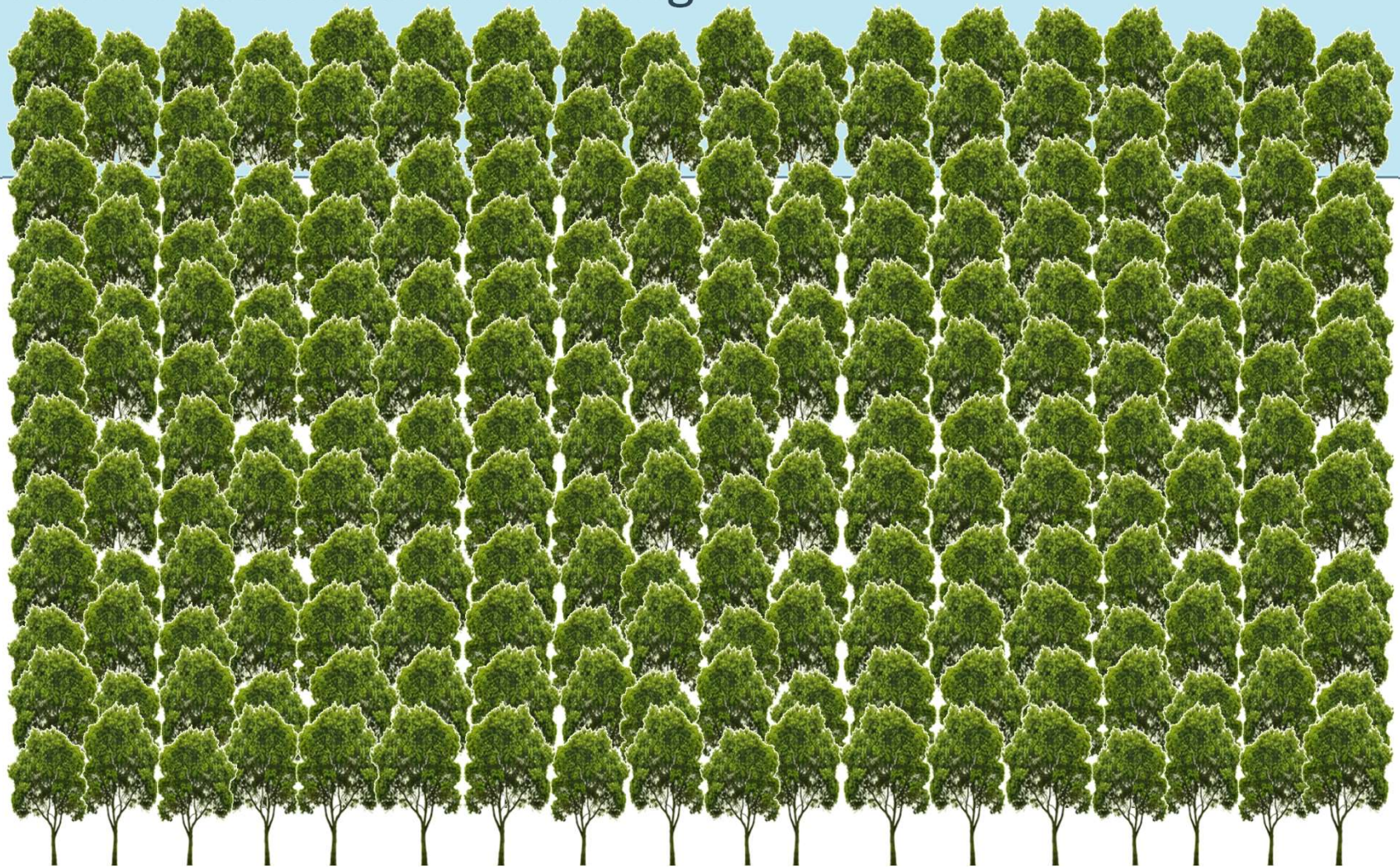


Broadleaf management - Thinning

- Emphasis on high quality, vigorous stems
- Selection is vital
- Select Potential Crop Trees (PCT)
 - Disease free
 - Good stem form
 - 6m ⇔ 5m ⇔ 4m ⇔ ...
 - Vigour
 - Distribution

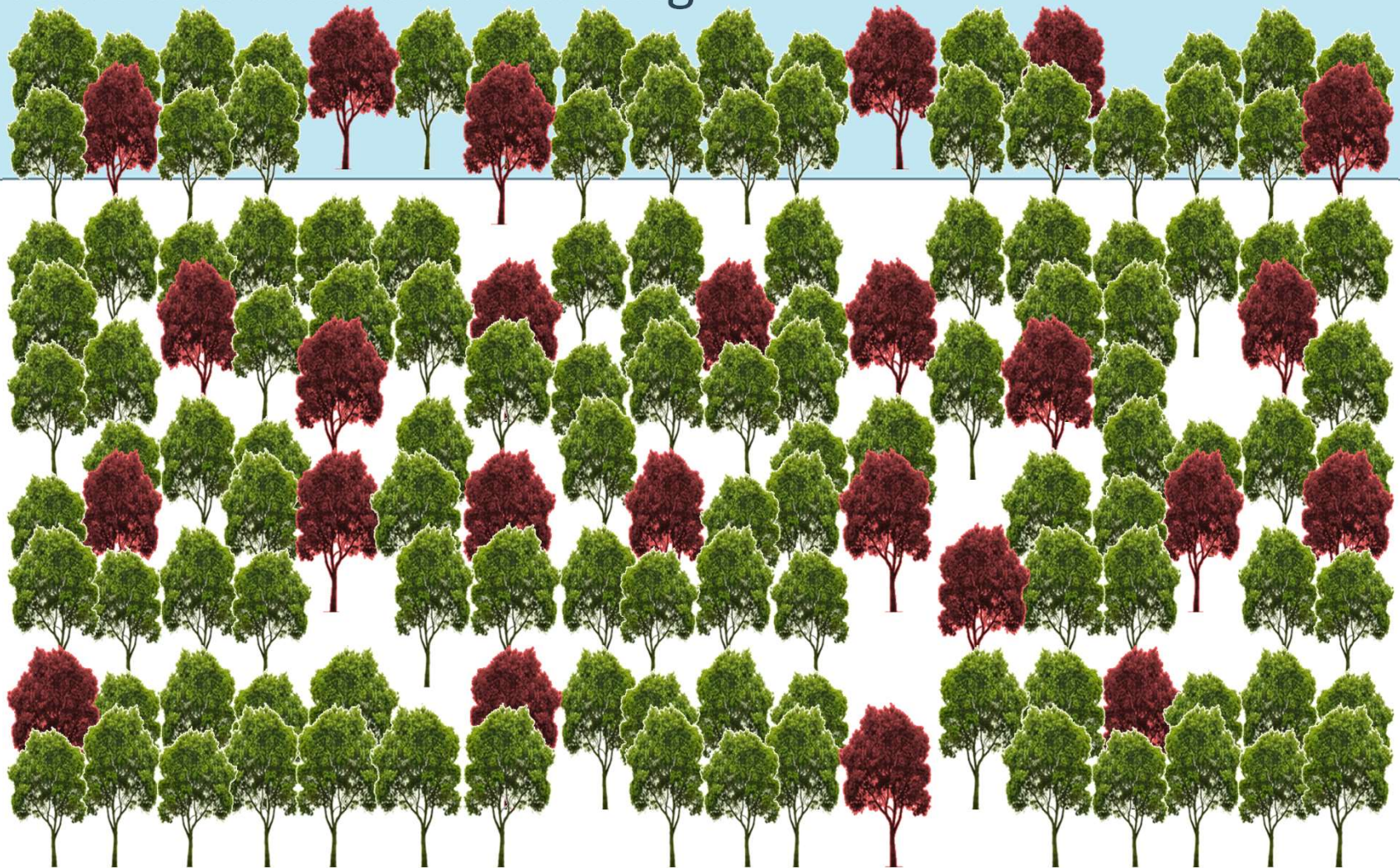


Rack and selection thinning



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Rack and selection thinning



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Rack and selection thinning



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Domestic firewood market

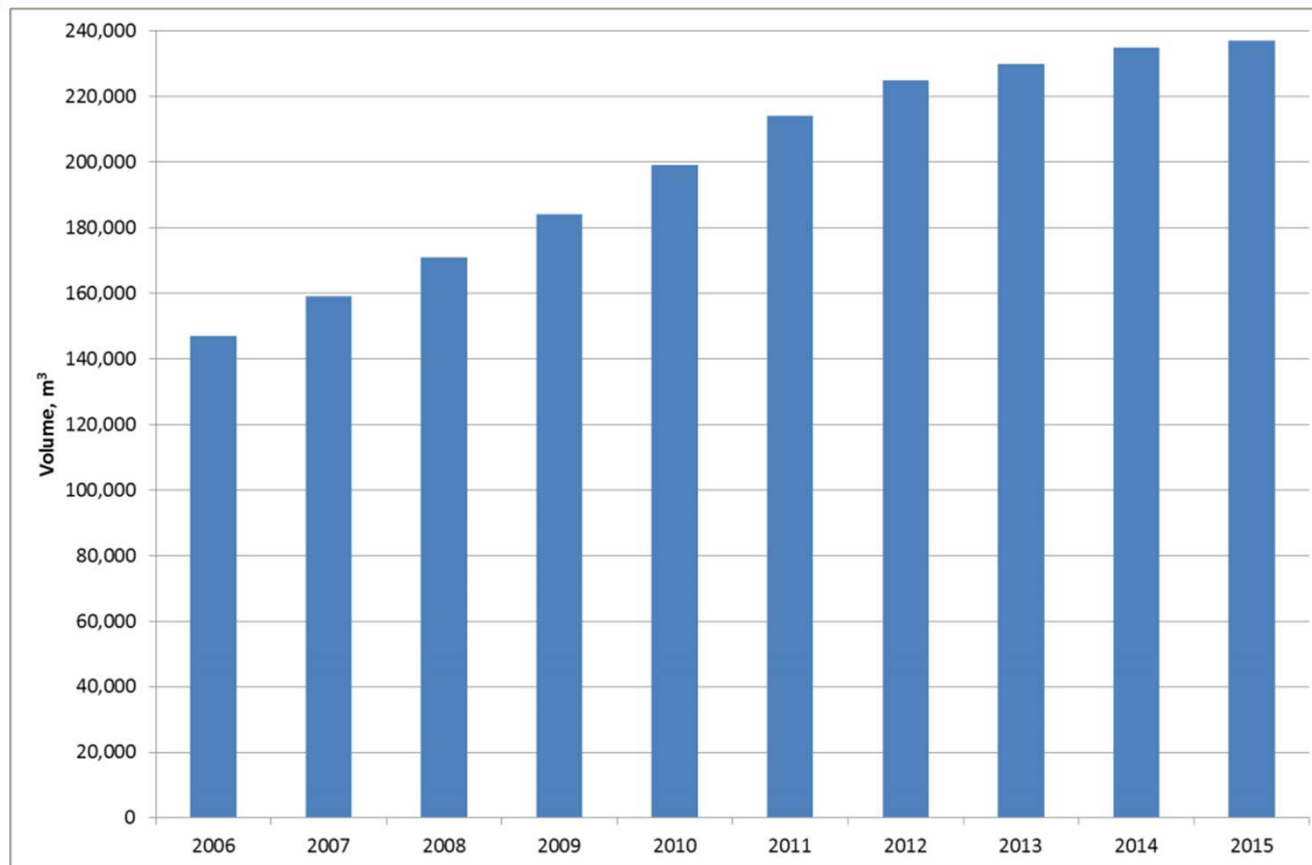


Figure 28. The domestic firewood market 2006-2015.



E.A.R.T.H. project

- Alternative uses of 1st and 2nd thinnings
 - alder; ash; birch; sycamore
 - Increased income to the forest owner



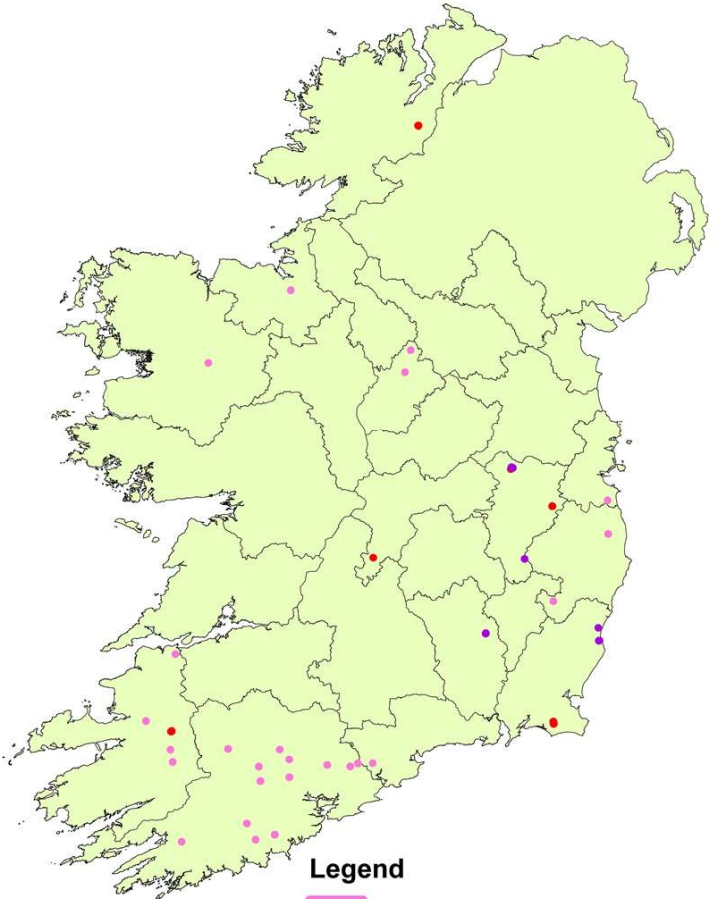
E.A.R.T.H. project

- Quantification of available resource
 - National Forest Inventory
 - Forest Service GIS: Afforestation grant; Thinning grant
 - Sampling for survey
 - Forest Service sent survey (Data Protection Act)
 - Request access to owners' forests



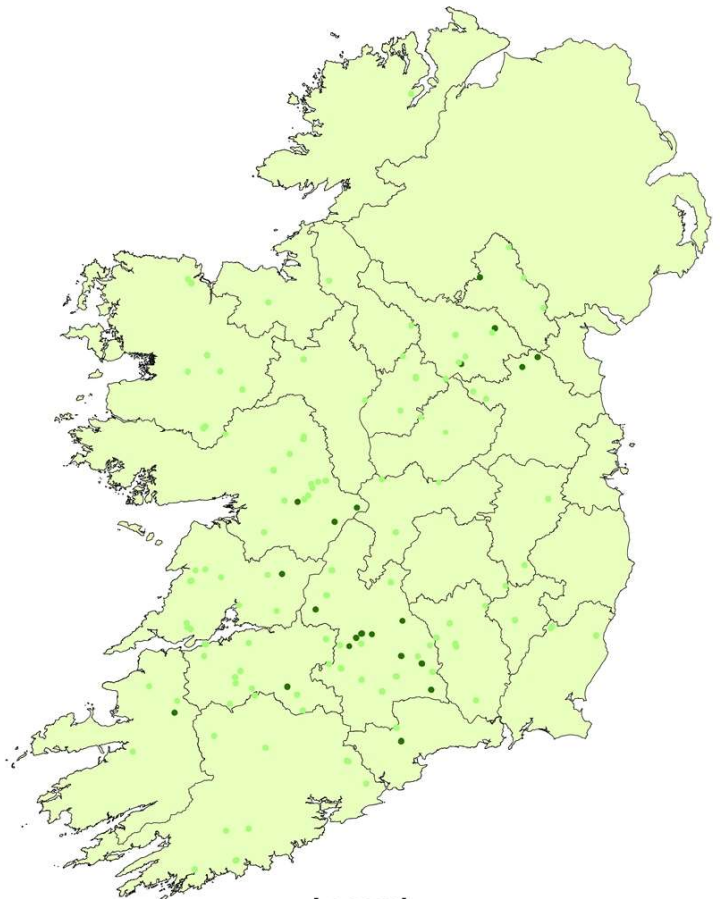
Survey recipients

E.A.R.T.H. site selection



- Legend**
- ALD_2000-2005_NoThin AMinDW CLEAN
 - ALD_2000-2005_NoThin BMinPD BMinSW
 - ALD_<2014_WIS selection CLEAN

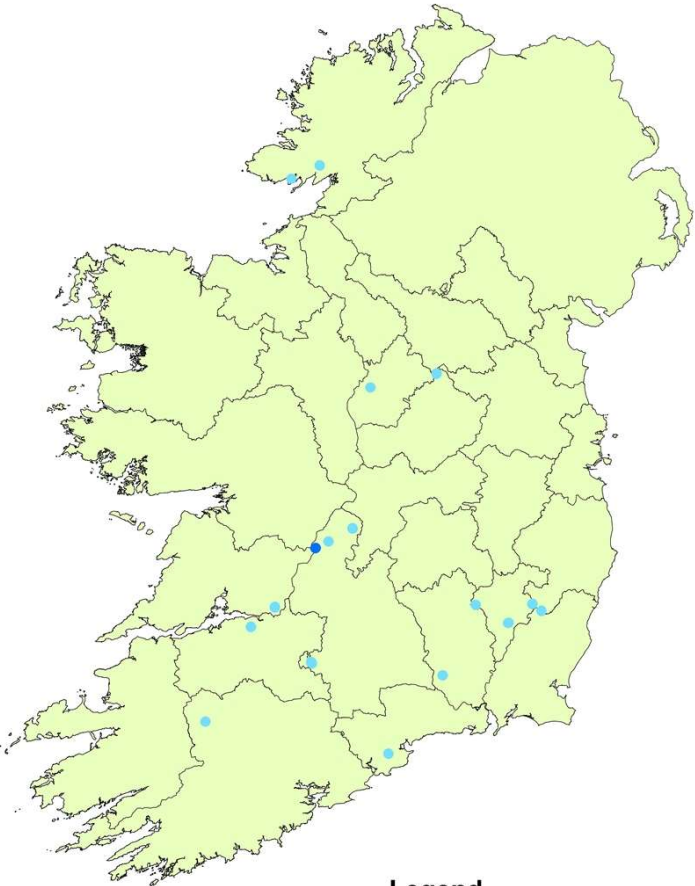
E.A.R.T.H. site selection



- Legend**
- ASH NoThin P2003-04 CLEAN
 - ASH Thin 2013-14

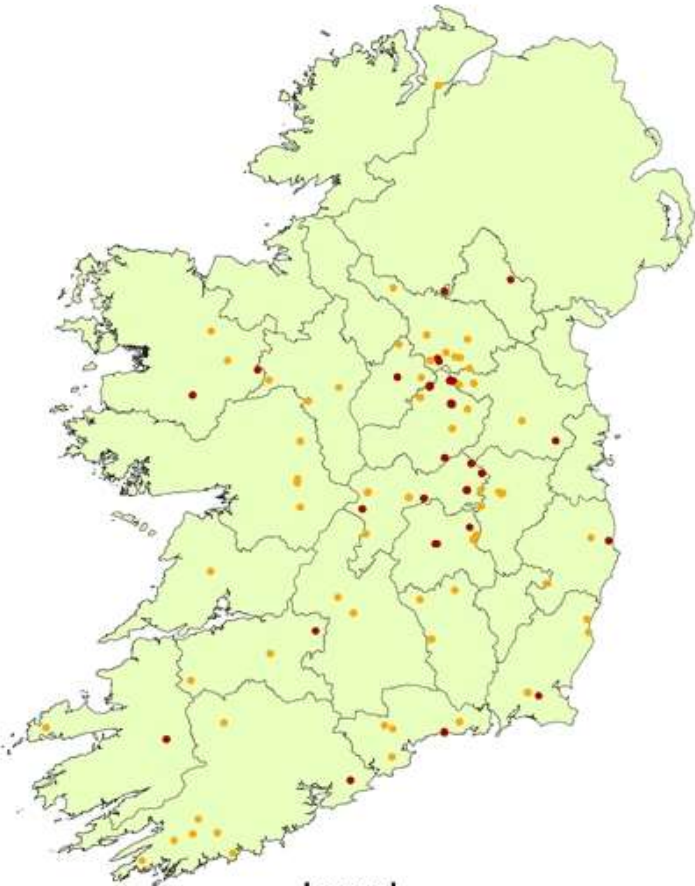
Survey recipients

E.A.R.T.H. site selection



- Legend**
- BI_2000-05 NoThin CLEAN
 - BI_Thinned

E.A.R.T.H. site selection



- Legend**
- SYC No Thin P2001-04 CLEAN
 - SYC Thin 2011-14

Fieldwork

- 20 x 20 m (0.04 ha)
- Stem diameter
- Height
- Tree selection
 - PCTs
 - Thinnings
- Random sampling of thinnings
- TreeSonic
- Felling and log samples
- MTG



Fieldwork



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Timber quality assessment

- Non-destructive testing (NDT) measurements:

- Treesonic (on standing trees) → ToF → $V=L/ToF$

$$E_{\text{dyn}} = \rho * v^2$$

- MTG (on green and dry logs) → Natural frequency → $V=2*f*L$



INIA Forest Products Laboratory, Madrid, Spain



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Timber quality assessment

- Mechanical testing
 - Four point bending test (EN 14251)
 - MOE
 - MOR
 - Density (from a slice)
- MOE & MOR estimation from NDT
 - From Velocity
 - From E_{dyn}
 - + other parameters (Knottiness)



Villanueva, J.L. (2009). Caracterización mecánica de rollizos de sabina (*Juniperus thurifera* L.) de Castilla y León. Prueba de clasificación visual y evaluación mediante resonancia. Universidad de Lérida, E.T.S.I. Agraria. 65 p.



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Drying

- Thinnings characteristics affecting drying:
 - Small diameters (from 10 to 20 cm)
 - Without debarked (hardwood bark is thin)
 - Without rounded (taper)
- Air drying (seasoning)
 - 40 logs of 2 m length (stored under cover)
- Kiln drying
- Combination air drying + kiln drying



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Drying

- Kiln drying
 - 80 logs of 2 m length (20 from each species)
 - Ends sealed to promote uniform drying
 - Evaluation parameters: Cracks, twist, color, ...
 - Different schedules:
 - Normal ones used in industry (sawn Sitka spruce) → ECC sawmill
 - Guide of Irish hardwoods (sawn hardwoods)
 - Other publications for roundwoods → GMIT Letterfrack



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Drying



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Durability

- Depends on Use Class (from 1 to 5)
- According to EN 350:2016 standard:
 - Durability (the 4 species are classified as Not Durable to fungi attack)
 - Treatability:
 - Easy to treat → Alder and Sycamore
 - Moderately easy to treat → Ash and Birch
- Durability study:
 - 80 logs 2 m length
 - Natural durability of some hardwood species
 - Preservatives treatment



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Identification of end-uses

- End-uses of round timber



USDA (2004). Construction Information. Small-Diameter Roundwood Kiosk



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Conclusions

- How results allow new end-uses:
 - Available species resource (amount, area and dispersion)
Alder, Ash, Birch and Sycamore
 - Mechanical properties (NDT ranks trees and green logs)
 - Drying kiln schedules (better quality final product)
 - Durability treatments (depends on Use Class)



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Thank you for your attention

Go raibh maith agaibh

E.A.R.T.H. Project (2017-2019)

<http://www.nuigalway.ie/terg/activeprojects/earthproject/>



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