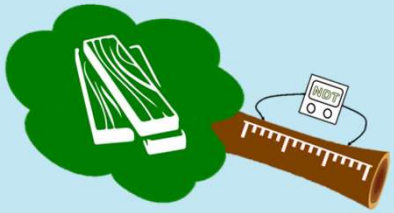
Exploitation And Realisation of Thinnings from Hardwoods
E.A.R.T.H.



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

Department of Agriculture, Food and the Marine
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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)

Hardwoods plantation situation

- Since 1990s government encourage private hardwood plantations
- First thinning is grant aided
- Second thinning is **not** grant aided
- Many thinnings are available now

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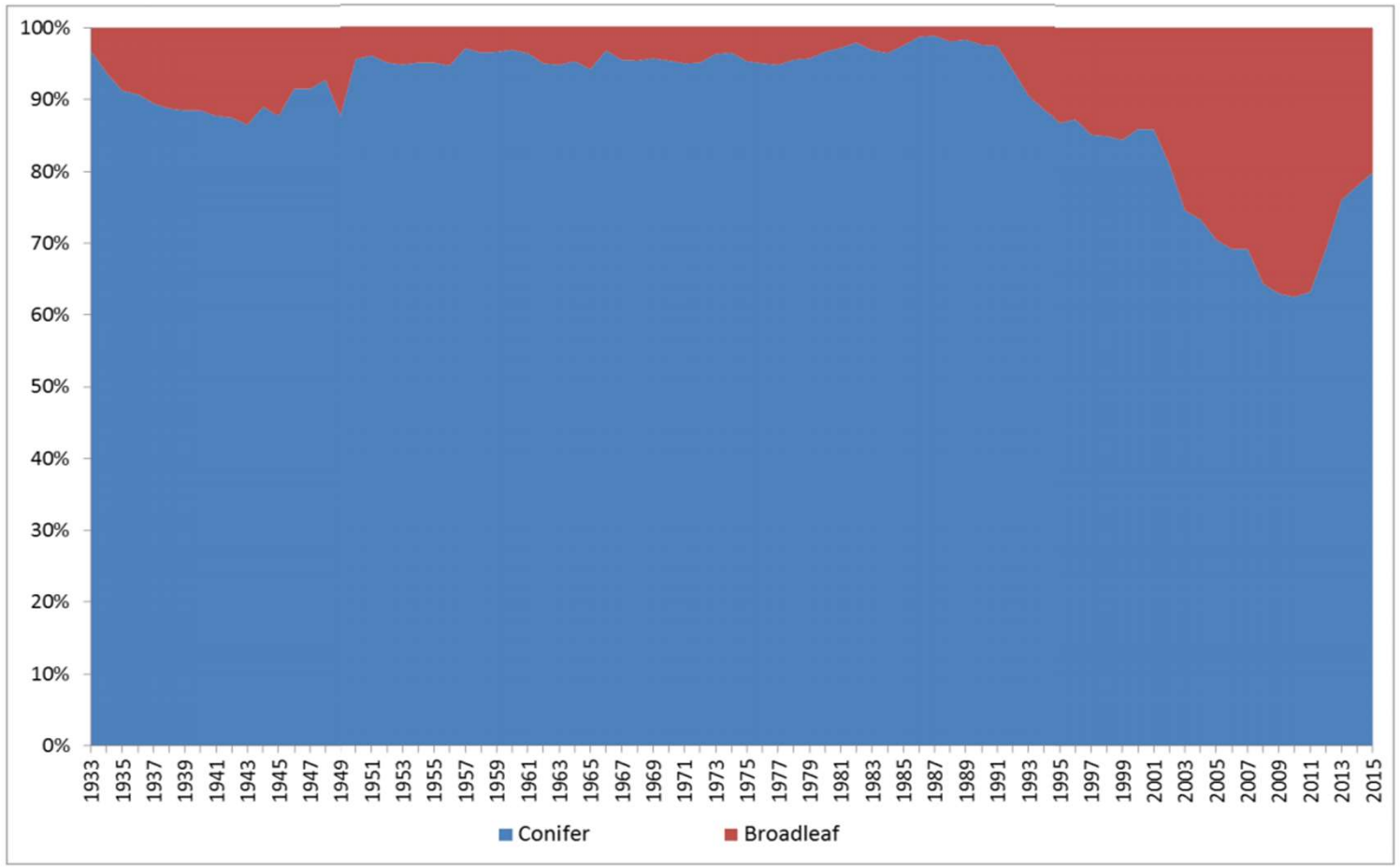
Softwood/Hardwood afforestation



Conifer - broadleaf afforestation 1933-2015.

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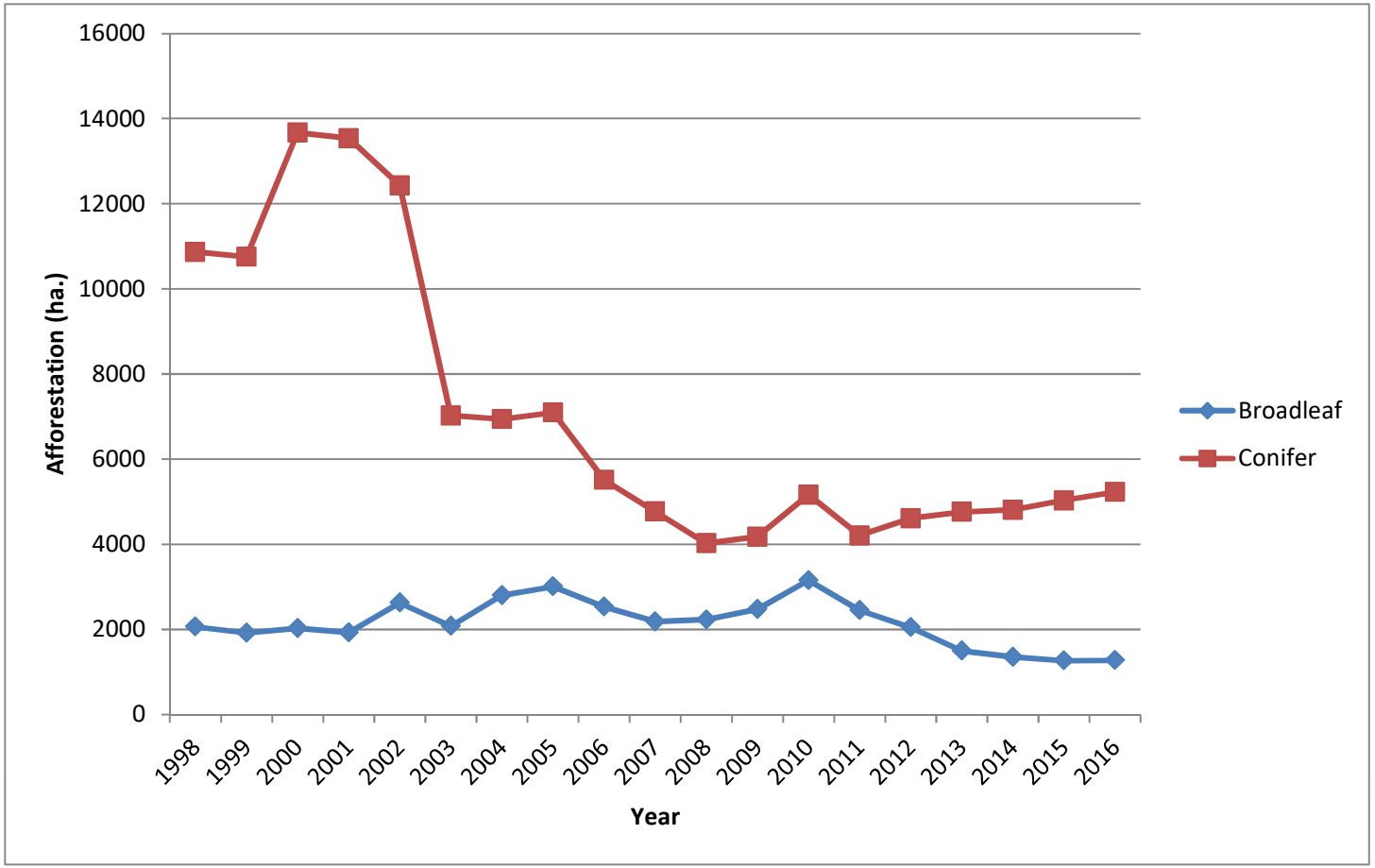
Afforestation



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Project objectives

- Quantify available 1st and 2nd hardwood thinnings
- Determine physical and mechanical properties
- Study drying and durability
- Potential end-uses for round timber

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Species studied

- Alder
- Ash (new plantations are forbidden since 2012)
- Birch
- Sycamore

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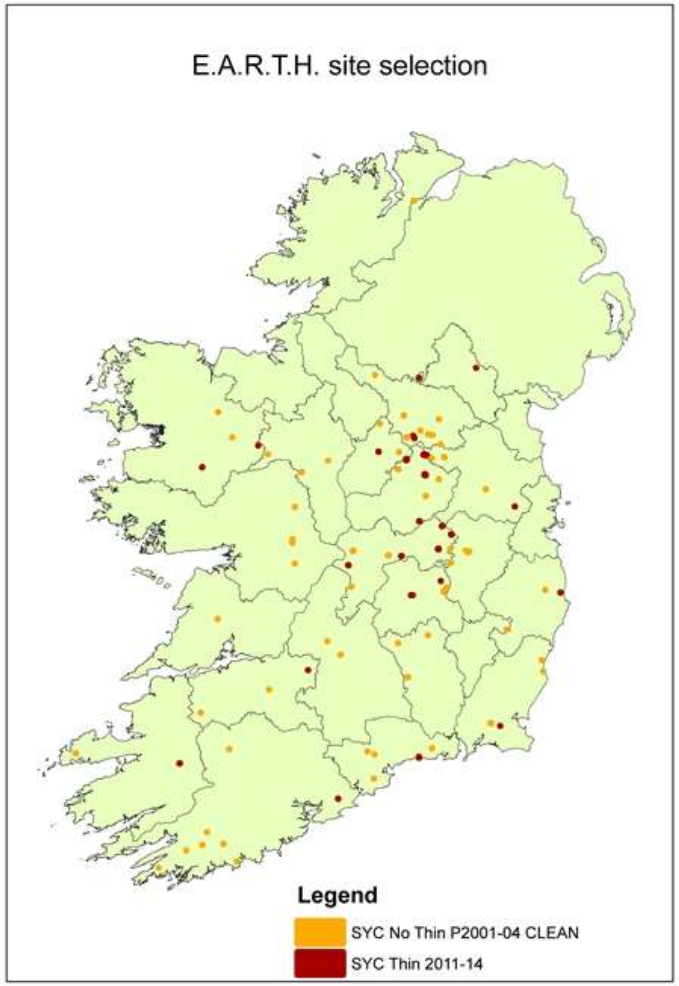
Sampling

- 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
      - Letters to 300 owners
      - c. 100 positive responses



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Fieldwork

- 20 x 20 m (0.04 ha)
- Stem diameter DBH
- Height
- Tree selection
  - PCTs
  - Thinnings (competitors)
  - Random sampling of thinnings

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Timber quality assessment

- Non-destructive testing (NDT) measurements:
  - Treesonic (on standing trees) → ToF → V=L/ToF
  - MTG (on green and dry logs) → Natural frequency → V=2*f*L

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

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Timber quality assessment

- NDT on dry logs in the lab
- Mechanical testing
  - Four point bending test (EN 14251)
    - MOE (Modulus of Elasticity)
    - MOR (Bending strength)
    - Density (from a slice)
- MOE & MOR estimation from NDT
  - From Velocity
  - From E_{dyn}
  - + other parameters (Knottiness)

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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)
- Kiln drying
- Air drying + kiln drying

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Air drying

- Air drying (seasoning)
  - Logs of 2 m length (stored under cover)

Kiln drying

- Kiln drying
  - Logs of 2 m length
    - 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 roundwood → GMIT Letterfrack

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Kiln 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:
  - 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

Galway playground

Wexford playground

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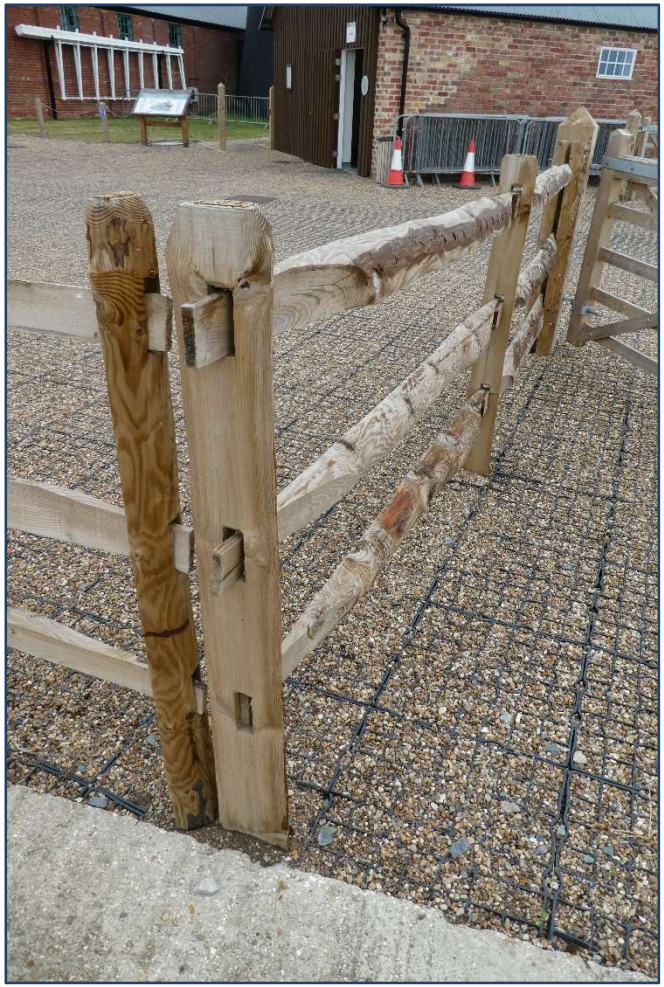
Identification of end-uses

- End-uses of round timber

Heckington windmill car park, Lincolnshire, UK



Identification of end-uses

- End-uses of round timber

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

Puerta de Hierro golf resort, Madrid, Spain

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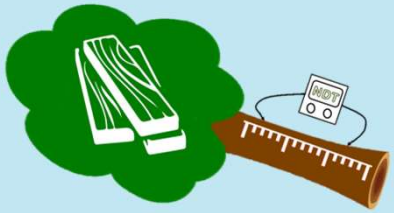
Conclusions

- 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)
  - Kiln drying schedules (better quality final product)
  - Durability treatments (depends on Use Class)

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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