




A long-term study of transformation to CCF in Sitka spruce in Ireland

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Continuous Cover Forestry Group | Webinar

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Permanent Close-to-Nature Forest Management


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Introduction


- Sitka spruce widely planted in Europe [1.2 M ha]
- Rotational forest management is dominant system [>95% area, UK/IRL]
- In Ireland:
 - Sitka spruce covers 52% of total forest area, 85% of timber production
 - State Forest Policy to promote forest resilience = greater role for Continuous Cover Forestry?




Distribution of Sitka spruce in Europe
Source: European Atlas of Forest Tree Species (2016)



Distribution of Sitka spruce in Ireland
Source: Farrelly et al. 2009



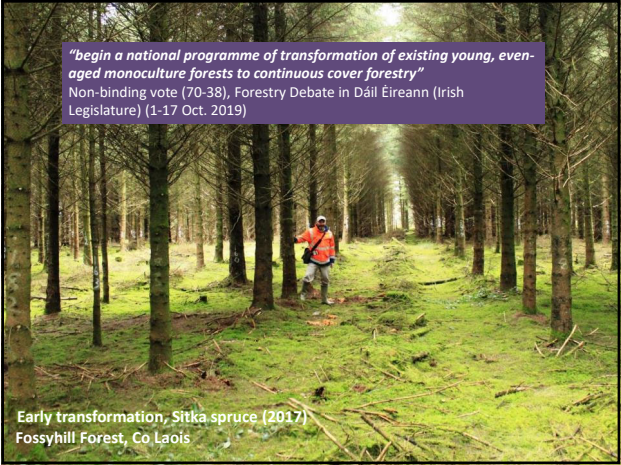
Rotational Forest Management
Conventional management system



Continuous Cover Forestry
Option for resilience and adaptation?

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"begin a national programme of transformation of existing young, even-aged monoculture forests to continuous cover forestry"
Non-binding vote (70-38), Forestry Debate in Dáil Éireann (Irish Legislature) (1-17 Oct. 2019)



Early transformation, Sitka spruce (2017)
Fossyhill Forest, Co. Laois

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Stand Transformation

Schütz 2001

A programme of stand interventions that facilitate the transition from an even-aged to an irregular structure stand.

1. Differentiation

- The focus is to promote each valuable element, ensuring structural development and stability

2. Promoting Regeneration

- The focus is on favouring new decentralised regeneration groups

3. Structural Development

- The focus is to achieve good horizontal and vertical distribution of structural elements

4. Structure Achievement

- The focus is to achieve vertical individualisation of the remaining groups

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Programme of Research: Early-Stage Transformation in Sitka Spruce

- The current priority is developing an **evidence-base** to support stand **transformation** from Rotational Forest Management (RFM) to CCF.
- **Objective: Compare conventional thinning with alternative thinning regimes associated with stand transformation**
- Sequence of research projects:
 - Phase 1: **LISS Project** (2010-14) - Ní Dhubháin, Vitkova
 - Phase 2: **TransSFor Project** (2017-22) - Ní Dhubháin, Short, Wilson
 - Phase 3: **ContinuFor Project** (2022-2027) - Ní Dhubháin, Short, Devaney, Jones, et al.

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Silvicultural objectives in Stand Transformation

Defining the research agenda

1. Sustain timber production

2. Promote timber quality

3. Transform structure

- Understand and **control stand basal area** (BA)
- Biological/ecological processes for regeneration/growth
- Vegetation and deer management

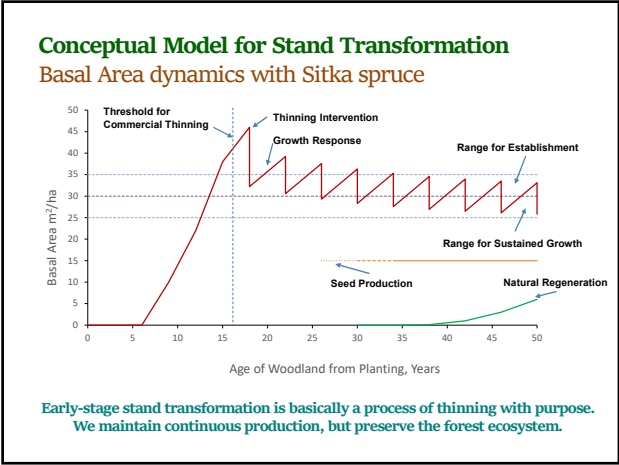
4. Promote anchorage of trees/stand stability

- Height:Diameter ratios
- **<60 = poor quality, 60-80 = stable, >80 = unstable**

5. Developing habitat and biodiversity attributes

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Experimental Design

- Sites**
 - Fossyhill, Co. Laois (Owner: Coillte)
 - 309 m, exposed
 - Gley soils
 - Ballycullen, Co. Wicklow (Owner: Private)
 - 250 m, sheltered
 - Brown earth soils
- Treatments**
 - Low thinning (Standard Thinning in Ireland)
 - Crown thinning
 - Graduated density thinning (GDT)
- Replication**
 - 3 blocks at each site
 - One treatment unit per block (randomised)
 - Each unit 50x50 m with 25 m buffer
 - 9 treatment units per site
- Interventions**
 - T1 – 2010, T2 – 2013, T3 – 2018 (FH), 2019 (BC), T4 – 2022

Low

Crown

Graduated Density

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TranSSFor - Experimental Design

Fossy Hill Forest (FH) | Co. Laois

Ballycullen Forest (BC) | Co. Wicklow

Treatments

L = Low
C = Crown
G = GDT

Image Credit: Robert Longpré, Bunsley

Forest	Altitude (m a.s.l.)	Soil type	Planting year	Yield Class (m³/ha·y)	Mean annual precipitation (mm·y⁻¹)	Prevailing wind
Fossy Hill	309	Gley	1992	22	1200-1400	South-west
Ballycullen	251	Brown earth	1995	22	800-1000	South-west

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LOW THINNING

Unit 01-L

Example plot from Fossy Hill Forest

Target Basal Area reduction (T3): FH 12.5% BC 20%
Marking Pattern:
Cutting cycle:

Selection Reasons:

(Positive Selection)	(Negative Selection)
-	Suppressed
-	Negative quality
-	Spacing
-	Damage

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Trees to consider removing in Low Thinning: “The Weeds and the Wolves”

Damaged and Poor Quality

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CROWN THINNING

Unit 02-C

Example plot from Fossy Hill Forest

Target Basal Area reduction (T3): FH 12.5% BC 20%
Marking Pattern:
Cutting cycle:

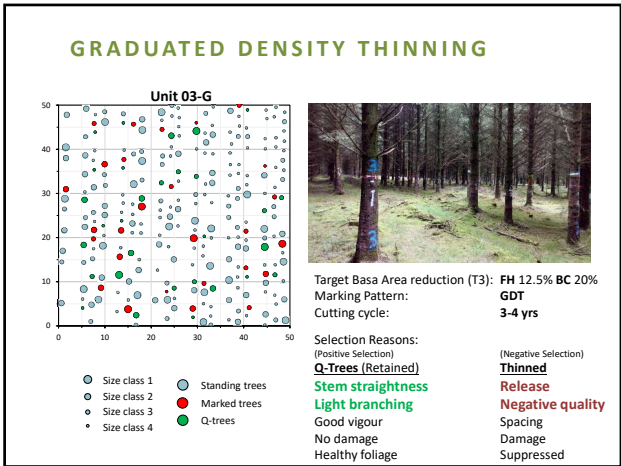
Selection Reasons:

(Positive Selection)	(Negative Selection)
Q-Trees (Retained)	Thinned
Stem straightness	Release
Light branching	Negative quality
Good vigour, stable	Spacing
No damage	Damage
Healthy foliage	Suppressed

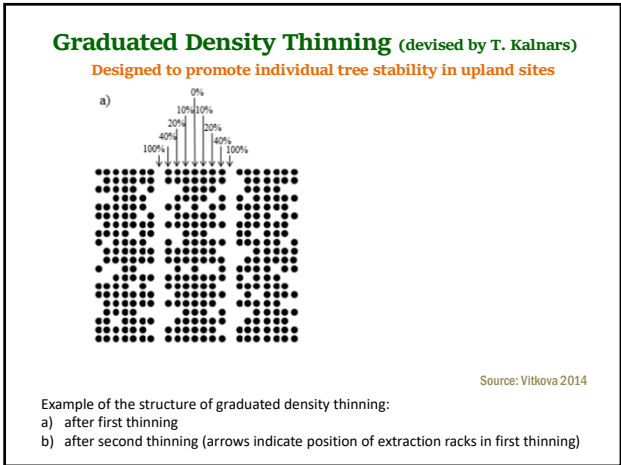
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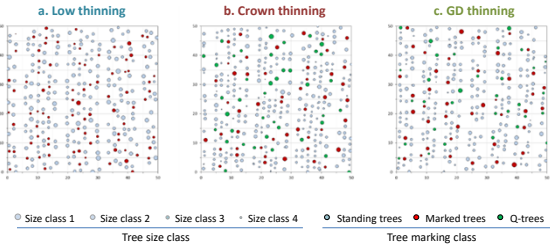


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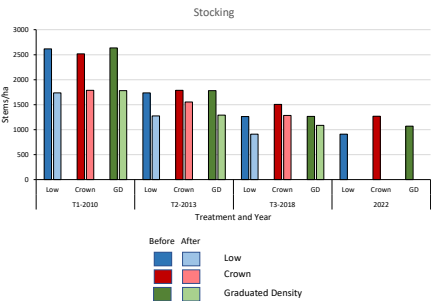
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Tree marking patterns at T3
Ballycullen Forest | 2018



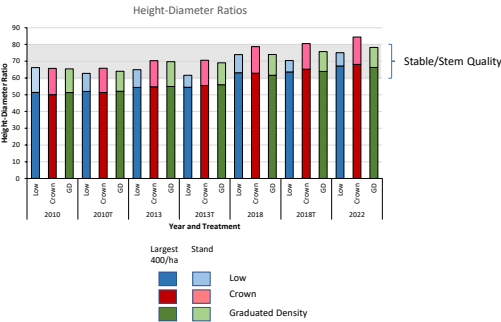
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Stand Density
Ballycullen Forest | 2010-2022



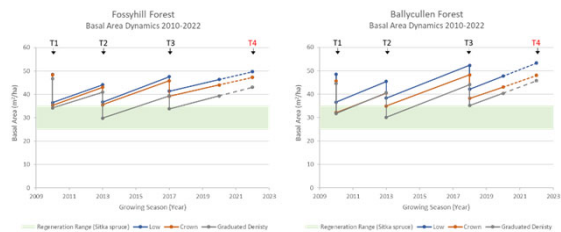
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Height-Diameter Ratios
Ballycullen Forest | 2010-2022



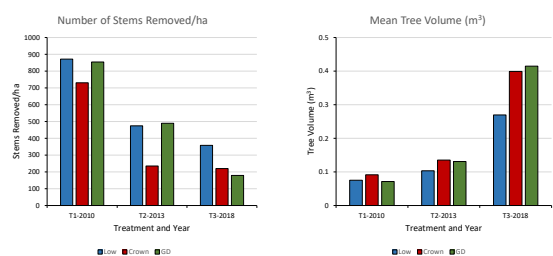
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Basal area dynamics T1-T3
Fossyhill and Ballycullen Forests | 2010-2022



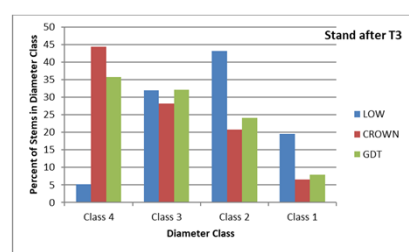
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Removals and mean tree volumes T1-T3
Ballycullen Forest | 2010-2022



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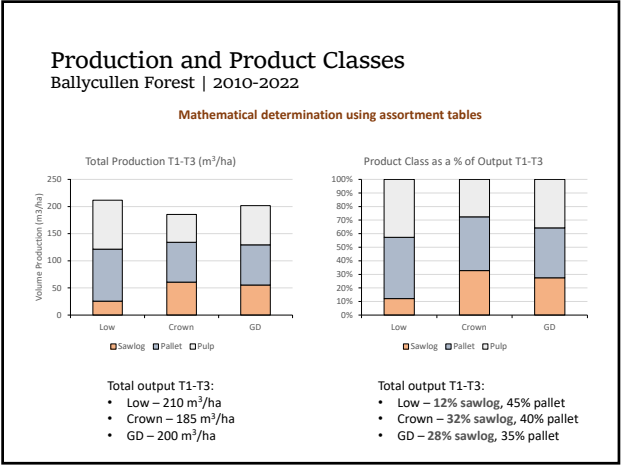
Size class distribution after Thinning
Ballycullen Forest | T3



Tree size classes are based on mean +/- SD in the Low Treatment

Crown thinning and Graduated density thinning: A high proportion of smaller trees are retained, compared with the Low thinning treatment. Larger trees retained in the Crown and Graduated Density treatments are mostly high quality specimens that are favoured through removal of nearby competitors.

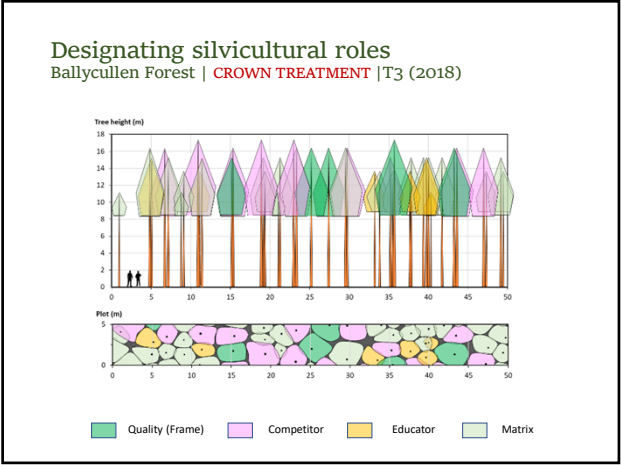
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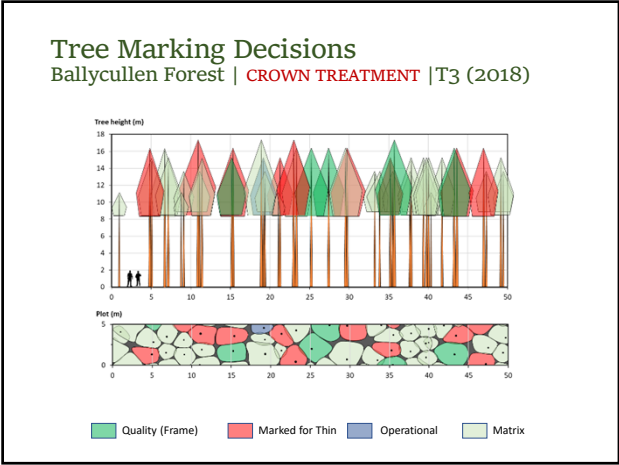
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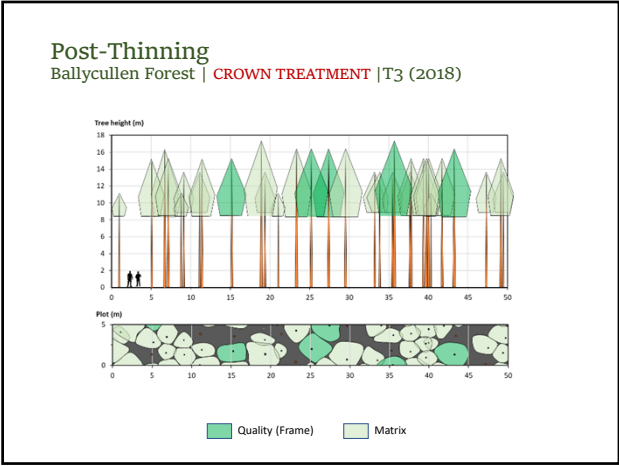
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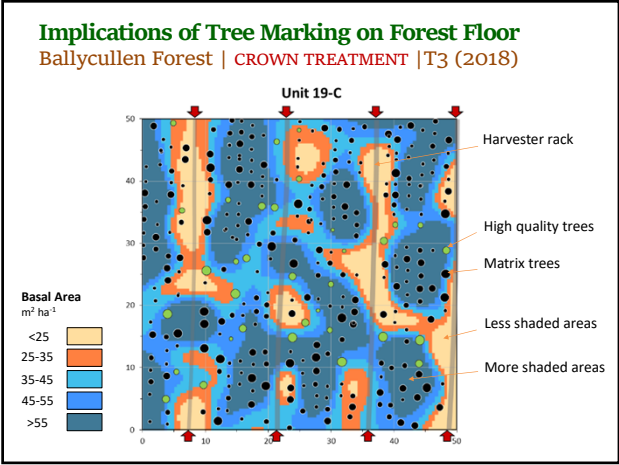
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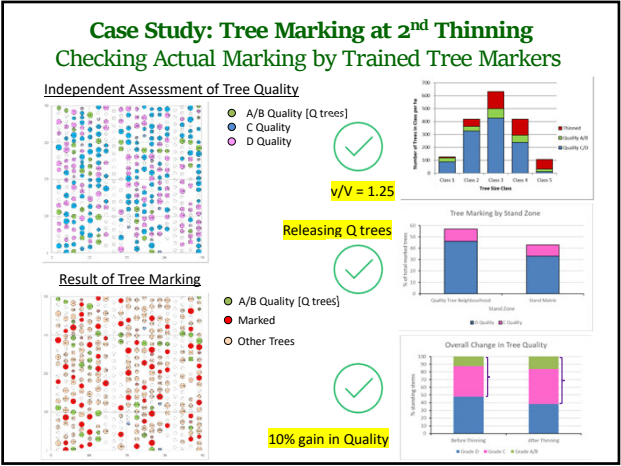


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Natural regeneration at Dunranhill Forest following 4th thinning intervention (2021)

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Summary and Conclusions

- There is significant interest in Continuous Cover Forestry in Ireland.
- Crown and graduated density thinning are being studied as potential pathways for early-stage transformation to CCF of Sitka spruce.
- Our preliminary results are demonstrating the development of structural irregularity, while also sustaining timber production and maintaining stand stability, in crown and graduated density thinning treatments.
- Crown and Graduated Density yield higher proportions of sawlog and pallet wood in early thinning stages compared with Low thinning.
- A key challenge is controlling basal area and developing appropriate conditions for initiation of natural regeneration.
- Continuing research is required to address site factors, forest operations, regeneration, timber quality, species mixtures, biodiversity (and social benefits of CCF).
- The research is strongly linked to knowledge transfer and training, which are key to the success of CCF.

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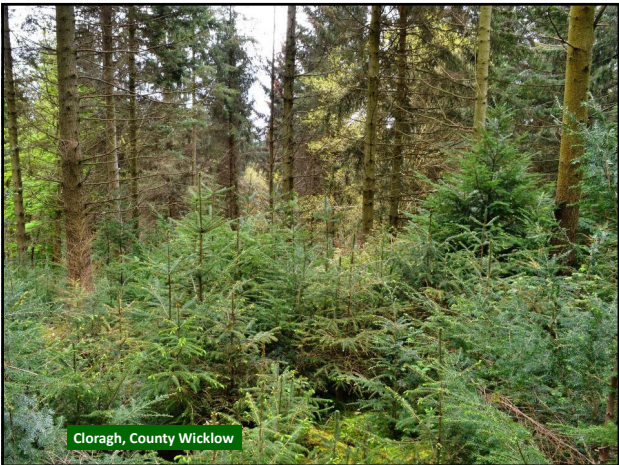
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