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Outline of Presentation

- Definitions and concepts
  - CCF, Transformation, Basal Area
- Overview of silviculture research
- Tree marking and training
- Conclusions

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Continuous Cover Forestry: an alternative approach

Continuous Cover Forestry (CCF):

- *"..the use of silvicultural systems whereby the forest canopy is maintained at one or more levels without clear felling."* **Mason et al. 1999**
- *" ... is a management option in which canopy cover is maintained continuously, the soil is never exposed, and clearfelling is avoided ..."* **Ní Dhubháin 2003**

Guiding principles:

1. Managing the forest ecosystem
2. Using natural processes
3. Working within site limitations
4. Diversifying stand structure

} Close-to-Nature forestry [CTNF]

- One of the most effective strategies for **resilience** and **multifunctionality**
- Can be applied to any forest type: mixed, broadleaf, conifer.
- Promoters: Pro Silva Europe (1989), Pro Silva Ireland (2000).

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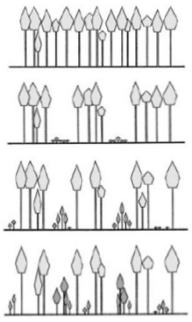
Stand Transformation Shütz 2001

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

1. **Differentiation**
   - The main aim is to promote each valuable element, which ensures 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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Basal Area

- An important parameter for quantifying a forest stand:
  - **Basal area of a tree** = cross-sectional area of a tree at breast height (1.3 m)
    - Easily calculated by determining the DBH of a tree.
  - **Stand basal area** = sum of the basal area of all (living) trees in a stand, expressed in m^2/ha
  - It may be seen as a summary of the number and the size of trees in a stand.
  - It is also correlated with competition or the density of a stand.
  - Useful as a guide for managing natural regeneration
  - Symbols are "BA" or "G"

Image: Wikipedia

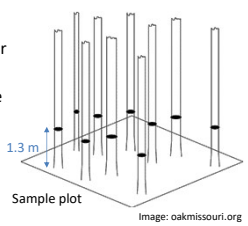

Image: oakmissouri.org

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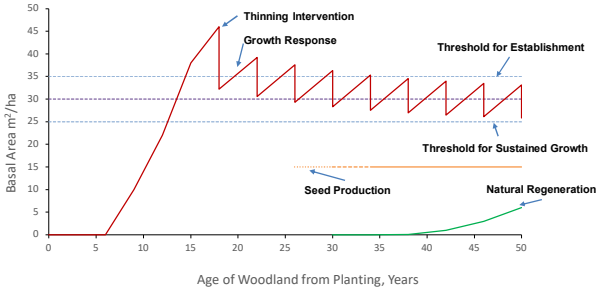
Conceptual Model for Stand Transformation

Basal Area dynamics with Sitka spruce



Stand transformation is basically a process of thinning with purpose
We maintain continuous production, but preserve the forest ecosystem

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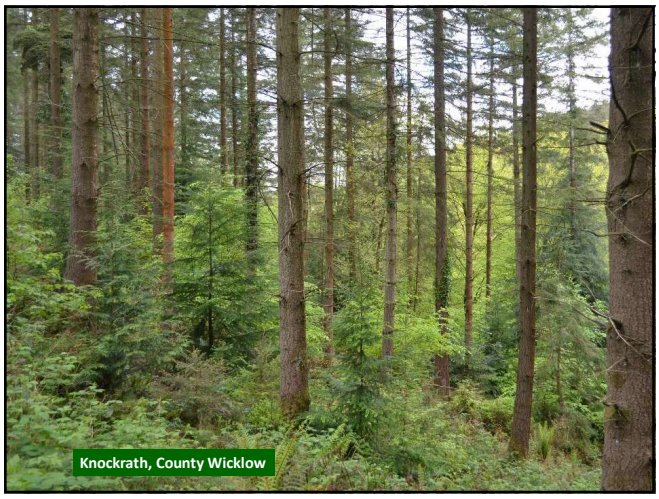

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Silvicultural Objectives in Stand Transformation

1. **Sustain timber <u>production</u>**
2. **Promote timber <u>quality</u>**
3. **<u>Transform structure</u>**
   - Understand and **control stand basal area** (BA)
   - Biological/ecological processes for regeneration/growth
   - Vegetation and deer management
4. **Promote anchorage of trees/<u>stand stability</u>**
   - Height:Diameter ratios
   - <60 = poor quality, **60-80 = stable**, >80 = unstable
5. **Retain habitat and biodiversity <u>attributes</u>**

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CCF Research – TranSSFor Project

- The current priority is developing an **evidence-base** to support stand **transformation** from RFM to CCF.
  1. **Compare conventional thinning with alternative thinning regimes associated with stand transformation.**
     - Assessing stand development (forest stand dynamics), production, timber quality, tree/stand stability, site impacts, regeneration
     - Phase 1: **LISS Project** (2010-14); Phase 2: **TranSSFor Project** (2017-22)
  2. **Develop appropriate training methods for CCF management.**
     - Tree marking and stand prescription design for early transformation

Teagasc Agriculture and Food Development Authority | UCD Dublin | TranSSFor Transformation of Sitka Spruce stands to Continuous Cover Forestry

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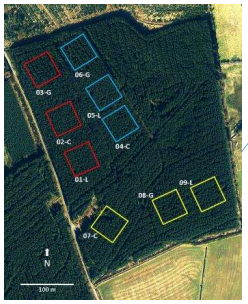
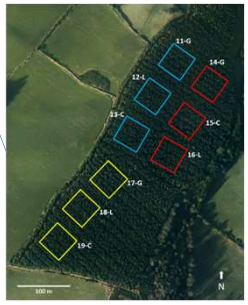
TranSSFor - Experimental Design

Fossy Hill Forest (FH) | Co. Laois



Ballycullen Forest (BC) | Co. Wicklow



Treatments
L = Low
C = Crown
G = GDT

Image Credit: Robert Loughran, Bluesky

Forest	Altitude (m a.s.l.)	Soil type	Planting year	Yield Class ($m^3 ha^{-1} y^{-1}$)	Mean annual precipitation ($mm \cdot y^{-1}$)	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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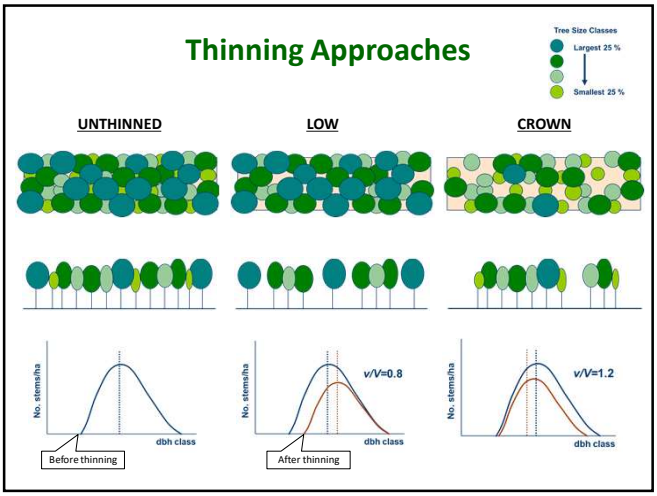
Thinning Approaches



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

Damaged and Poor Quality

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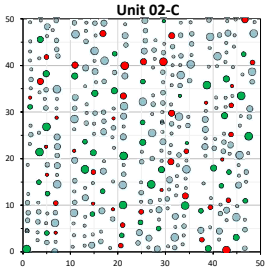
CROWN THINNING



Example plot from Fossy Hill Forest

Target Basal Area reduction: **FH** 12.5% **BC** 20%
Marking Pattern: **Crown**
Cutting cycle: **3-4 yrs**

Selection Reasons:

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

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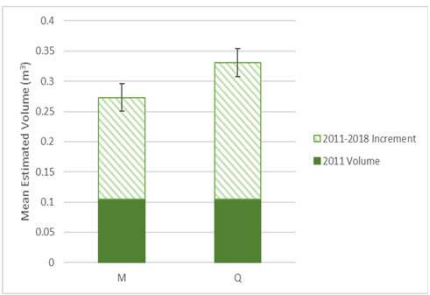
Concentrating Increment on High Quality Trees

Mean tree volume (m^3) for 2011 and 2018
for Q-trees and Matrix trees



Credit: Fraser Wight [BSc (Hons) Aberdeen 2020]

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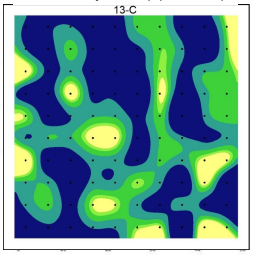
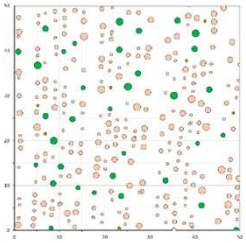
TranSSFor - Ballycullen Forest

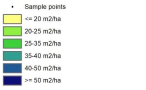
Plot 13-Crown Thinning

c. Understorey heatmap (basal area)



b. Tree size classes and marking plan





- Q tree (marked for retention as future crop tree)
- Matrix/Rack tree (retained after thinning)
- Standing dead (retained after thinning)

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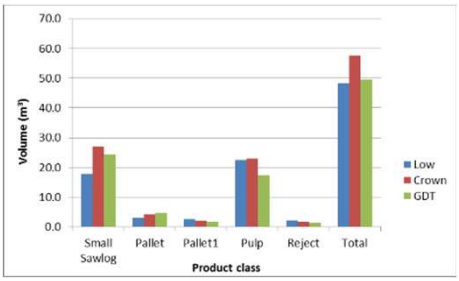
Production at the 3rd thinning | Fossyhill Forest



Treatment	No. Stems (Stems/ha)	Volume (m^3/tree)
Low	216	0.20
Crown	166	0.25
GDT	128	0.30

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Decision Making at the Tree Level

Knowledge Transfer | Training

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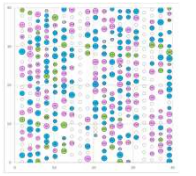
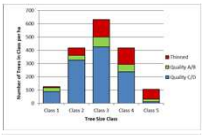
Case Study: Tree Marking at 2nd Thinning

by Trained and Experienced Tree Markers

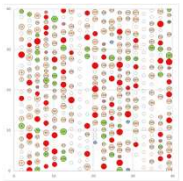
Independent Assessment of Tree Quality



- A/B Quality [Q trees]
- C Quality
- D Quality



Result of Tree Marking



- A/B Quality [Q trees]
- Marked
- Other Trees

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CCF at Dunranhill Forest

Wilson, Wirz and Byrne 2021

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Summary and Conclusions

- CCF is one of the most important strategies for promoting forest resilience
- Crown and graduated density thinning are being studied as potential pathways for stand transformation to CCF
- Current research is focusing on stand structure, timber production and quality in Sitka spruce
- Knowledge transfer and training are key elements to the success of CCF, and assist practitioners in developing their “silvicultural tool kit”
- Vital role for Pro Silva Ireland in exchange of ideas and training within Ireland, with Europe
- Continuing research is required to address site factors, forest operations, regeneration, timber quality, biodiversity (and social benefits of CCF)

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Transforming Irish Forests through Continuous Cover Forestry

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