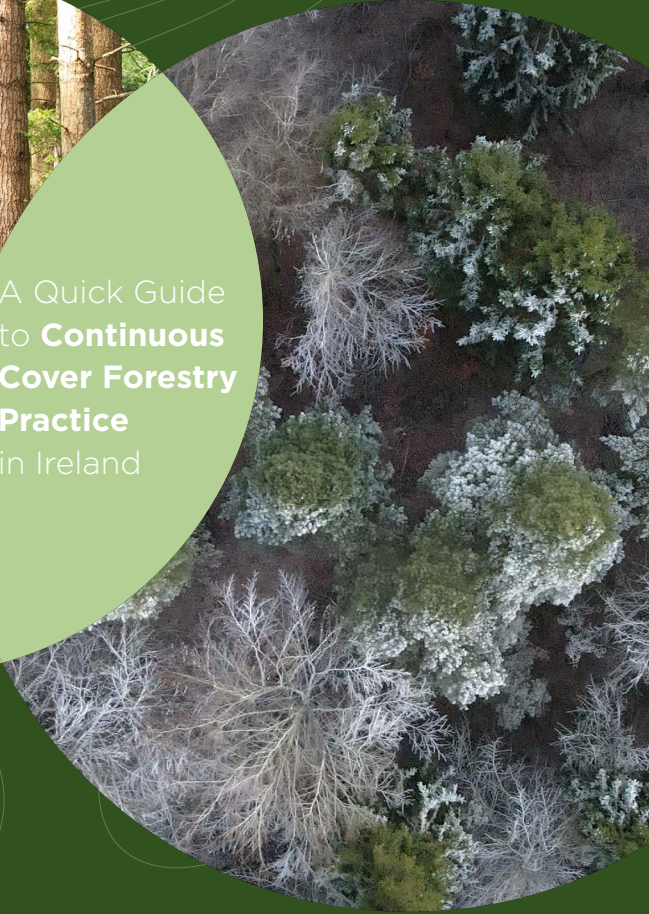




A Quick Guide to **Continuous Cover Forestry Practice** in Ireland



Understanding CCF transformation



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What is CCF transformation?

Transformation in continuous cover forestry (CCF) is the gradual process of converting an existing even-aged plantation, composed of a single species or a limited species mix, into a structurally diverse, mixed forest.



Why use existing plantations?

In Ireland, CCF transformation is commonly undertaken in even-aged conifer plantations, typically dominated by a single species or a limited species mix.

These existing plantations already provide important benefits:

- Soil is protected from erosion
- There is a growing timber stock
- A humus layer has developed
- A forest microclimate has formed
- Carbon is being sequestered
- Biodiversity niches, additional to the planted trees, are often present

All of these features make such stands a strong foundation for transformation to CCF forests.

Similarly, transformation can also be initiated in even-aged broadleaf monocultures to enhance structural diversity, species mixture and resilience.

Many older mixed woodlands already exhibit many desired CCF features, including species diversity and structural irregularity. These may only need continued CCF management rather than full transformation.

Choosing a stand for transformation

Many types of plantations can be transformed, but the ease and speed of the process depends on several factors.



Tree species

Having some species diversity present in a forest helps facilitate transformation.

Stage of development

It is best to initiate transformation at the first thinning intervention or as early as possible thereafter.

Past management

Stands with few previous felling interventions present more options for tree selection in the transformation process.

Existing seed sources

Mature trees within or nearby the site indicate possibilities for natural regeneration in the future.

Poor candidates for CCF transformation are stands where:

- The first thinning has been substantially delayed;
- Stands at later thinning stages, with trees that have disproportionate height-to-diameter ratios and small or receded crowns;
- The site is very exposed;
- Soils are peaty or gleyed and long-term stability is likely to be compromised.

Stand stability

Stand stability is a key factor when deciding whether a forest is suitable for CCF transformation. Stands must be able to sustain thinnings without being blown over.

When a stand is too unstable, it may be better to clear-fell and replant with a mix of tree species in an irregular layout suitable for CCF management, even though this temporarily removes forest conditions.

When to start

First or second thinning is an ideal time to start transformation. Transformation of older stands on certain stable sites is also possible but particular attention to stability is needed.

How transformation progresses

Transformation is a gradual process guided by selective felling. In CCF, selective felling refers to the selection of individual trees for removal or retention.

This is a management technique used to shape the stand and achieve CCF management objectives. Trees carefully selected for removal release remaining trees from competition, improving the quality of timber in the stand, encouraging natural regeneration, and maintaining and supporting a healthy forest ecosystem. Through this process, the forest gradually moves toward a fully irregular structure.

Early felling interventions typically take the form of a thinning, progressing over time to include the selective harvest of higher-value sawlog trees within the ongoing felling cycle.

Across all stages:

- The focus is releasing quality, retaining stability and encouraging regeneration
- Selective felling directs the transformation process
- Tree assessment methods remain the same

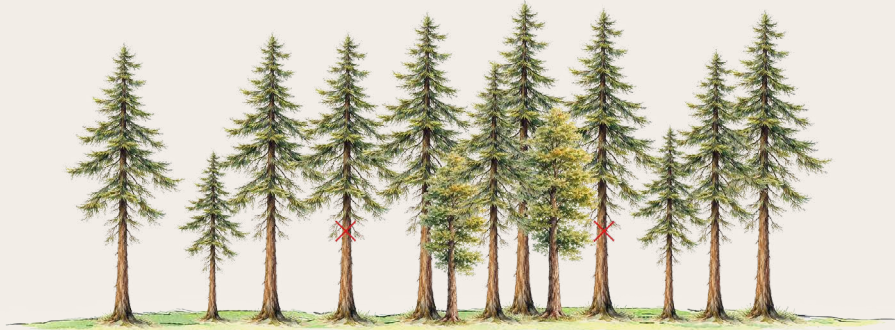
Transformation requires care and patience, balancing stand stability with the creation of space and light to allow natural regeneration to develop over time.



Basal area and regeneration

Basal area per hectare measures the area occupied by tree stems within a hectare of forest. It is a useful metric for CCF transformation; pre-harvest measurement gives an indication of existing stocking and light regimes. This informs what felling intensity is needed to reduce basal area to a level where growth is focused on quality trees and where enough light reaches the forest floor to promote natural regeneration.

Stages of transformation



1 Initiating transformation

Early thinnings maintain and promote stability, improve stand quality and establish long-term harvesting infrastructure.



2 Continued transformation

Felling interventions continue to enhance quality, promote tree species diversity and manage light levels to support natural regeneration.



3 Late-stage transformation

Interventions are focused on developing structural diversity, ensuring the presence of trees at all development stages, from seedlings and saplings through to mature trees.



4 Maintaining the CCF forest

Management focuses on harvesting the forest growth increment, while sustaining a resilient, healthy forest ecosystem, through regular felling interventions.



How long does transformation take?

The time required to transform a plantation into a CCF forest depends on the condition and composition of the stand at the outset. Some sites respond relatively quickly to selective felling interventions, with the development of well-formed canopy crowns and the presence of early natural regeneration.

Other plantations are a longer-term prospect, requiring light, regular thinning interventions to enhance stability throughout the transformation process. Where suitable seed sources are absent, enrichment planting may be necessary to introduce desired species.

Example

A Sitka spruce stand on stable soils beginning transformation at second thinning may take around 40 years to fully develop into a CCF forest.

In Ireland, some of the earliest sites to begin transformation—mixed conifer stands managed under CCF for around 25 years—have now reached late-stage transformation. These forests display a multitiered canopy with large, high-quality conifers, quality pole stage trees of the original stocking species, and a developing understorey of regenerated conifers and native woodland species.

Economics

Different approaches to forest management yield different cash-flows, particularly when comparing the predominant Irish clear-fell and restock system with CCF.

Under the clear-fell model, income is typically realised as a large payment at the end of each rotation, followed by a period of reinvestment to restock and maintain the new forest, and a prolonged interval while the asset matures towards the next clear-fell.

By contrast, CCF management develops the forest to a point where the growth increment can be harvested at regular intervals on an ongoing basis. This provides regular income from timber sales without the need for restocking costs, while the principal asset (the baseline standing volume of timber) is maintained.

Forests can also generate income from non-timber products, such as food or foliage, and from other sources, such as tourism, private hunting fees and film location fees. In most cases, a permanent CCF forest is better placed to support these additional income streams.

Markets

Most sawmills currently process smaller sawlogs, but high-quality large logs still achieve good prices in Ireland. As more CCF forests mature, demand for these larger logs is likely to grow. The percentage recovery of sawn timber from large logs of good quality is higher than smaller logs of similar quality, creating future efficiencies for sawmills.



Guidelines for assessing a forest for CCF transformation

Forests are typically considered for CCF management in several ways.

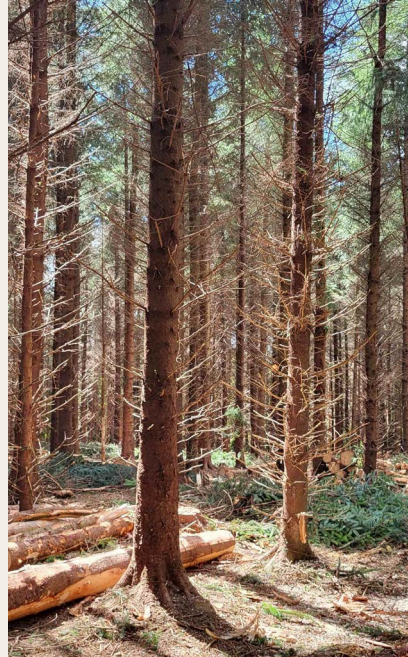
1. The forest owner has already decided to adopt a CCF management approach.
2. The owner has defined multiple management objectives, such as timber production, biodiversity and resilience, for which CCF offers the most suitable management approach.
3. A forester or ecologist may identify a forest that already exhibits a high level of species or structural diversity and is therefore well suited to CCF management.

In all cases, an initial on-site assessment is required to evaluate the forest's suitability for CCF management, to identify both opportunities and constraints and to determine the most appropriate initial intervention.

Decisions on management interventions are guided by three main elements:

- The owner's objectives
- The CCF principles
- The specific physical and environmental characteristics of the forest

These characteristics include age and species profile, past management, soil type, site conditions, exposure and climate.



The depth and extent of the assessment will depend on the scale of the forest, available resources and management aims. As with any forestry inspection, an experienced forester will assess the general condition and developmental stage of the stand. In a CCF context, this is supported by a more structured focus on diversity, stability and regeneration potential.

Access and operational feasibility

CCF management requires safe and practical access for repeated interventions over time. Existing access routes, stacking areas and turning space for timber lorries should be assessed. Alternatively, determine where they should be established at the first thinning.

Rack infrastructure should also be evaluated for suitability; poorly laid-out or closely spaced racks may limit future management options and might imply some future rack abandonment to natural regeneration.

Stand structure and diversity

The number of stands should be noted, along with any natural features or areas of interest. These may include wet or poorly stocked areas where planting has failed and site-adapted species have naturally colonised. Such areas often represent opportunities for biodiversity enhancement and nodes from which to expand natural regeneration in the future.

Within each stand, key characteristics should be recorded, including:

- Approximate age
- Species present and stocking levels
- Average diameter (DBH) of primary tree species
- Average height of primary tree species
- Suitability for thinning

Particular attention should be given to minority species, including older trees that may pre-date planting, often found along former hedgerows. The presence of natural regeneration, whether under canopy, in gaps or in windblown areas, should also be noted, as this provides valuable insight into site suitability and potential future species composition.



Minority species and regeneration potential

Minority species should be assessed in terms of their condition and where their value lies, whether in timber quality, biodiversity contribution or as seed sources for regeneration. These considerations are central to later tree selection and marking, but early assessment helps guide longer-term management decisions.

Previous management and stability

Understanding past management is critical. Was the forest thinned previously, and if so, how? For example, heavy low thinnings that remove smaller and poorer-quality trees can result in more uniform stand structure, thereby limiting opportunities to develop irregular tree-size distribution during early stages of transformation. Alternatively, long-delayed thinnings can result in tall, slender trees with reduced crown depth, potentially increasing windthrow risk.

Some instability is common, particularly when transforming even-aged plantations. Where unstable areas are small and irregularly distributed, they can present an opportunity for biodiversity and natural regeneration and are accommodated within CCF management.

However, if a stand is assessed as highly unstable and unlikely to tolerate thinning without significant windthrow risk, CCF may not be appropriate at that stage. In such cases, clear-felling and re-establishment with future CCF management in mind may be the preferred option.

Stability is a key factor in assessing suitability for CCF and is influenced by:

- Tree height versus diameter (DBH) ratio
- Crown depth (trees with deeper crowns are more stable)
- Soil type and structure
- Location and exposure
- Management history

Soils and ecology

Soil type should be assessed through probing or sample pits. In general, dry mineral soils are most favourable for transformation to CCF, followed by wet mineral soils, with peat soils presenting additional challenges.

Ecological and biodiversity features should be identified and recorded, including standing and fallen deadwood, veteran trees, watercourses and signs of wildlife activity. These features provide important context for management decisions and help ensure that CCF interventions support both timber production and ecological objectives.



Guidelines for selective felling in transformation

- **Resist** the temptation to 'clean up' by removing smaller trees. Their removal is an added cost; smaller trees add structural variety and generally don't compete with quality trees in the high canopy.
- **Remove** large, poorly formed (biggest/baddest) trees. This creates space and light for quality trees and regeneration. It also increases the harvest volume for sale from early thinnings. Some wolf trees can be ring barked to create standing deadwood where necessary.
- **Maintain** size diversity. If few large trees are of good quality, keep some large, poorer-quality trees to retain height variation and stability.
- **Protect** stand stability. This is especially important in older even-aged stands. Thin lightly but more frequently to allow the stand time to stabilise.
- **Respect** bio groups. Two or more closely grown trees that share rooting and crown behaviour are particularly good for stand stability. They should be managed as one unit.
- **Retain** trees with deep crowns. Trees with deep crowns (one-third to one-half of tree height) grow vigorously and have a lower centre of gravity, helping stability.
- **Create** deadwood. Both fallen and standing deadwood are valuable for biodiversity.
- **Use** natural disturbance. Windthrow can remove unstable trees and create regeneration gaps.
- **Give** broadleaves more space. Broadleaves and deciduous conifers (such as larch) need wider crowns and should be released earlier and more aggressively than conifers.



USEFUL TERMS

Thinning

The planned removal of selected trees within a stand to regulate density and enhance the growth and stability of retained trees.

Even-aged plantation

A planted forest in which the trees are the same age and managed through distinct stages to a final harvest.

Irregular forest

A forest characterised by a complex structure, with trees of multiple age classes and sizes, and a layered canopy.

Selective felling

The removal of individual or small groups of trees to release (give space to) trees that have been selected for retention, based on their quality for timber production, their biodiversity value and/or other silviculture objectives.

The CCF principles:

1. Conservation of the forest ecosystem
2. Protection of soil and climate
3. Production of timber and other forest products
4. Provision of cultural, recreation and amenity services



Pro Silva Ireland is a registered charity founded in 2000 to advocate for, and educate on, continuous cover forestry. Part of the wider Pro Silva Europe network, Pro Silva Ireland is an all-Ireland organisation, embracing membership from both Northern Ireland and the Irish Republic.

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Other guides in this series:

- What is CCF?
- Benefits of CCF
- CCF and biodiversity
- CCF forests for water
- Tree selection and marking in CCF
- Enrichment planting in CCF
- Light forest operations
- Guidelines for CCF harvest operations
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