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

06

Tree selection and marking in CCF

PRO SILVA IRELAND

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Continuous cover forestry (CCF) is an approach to forest management that works with natural processes to produce quality timber, while maintaining and enhancing other forest functions within a permanent forest structure.

In CCF, tree selection for thinning and harvest is the primary approach for guiding the development of a forest. Selective felling, informed by economic, silviculture and conservation objectives, steers the forest toward the desired outcomes of CCF management.

Trees are not removed according to a regular pattern. Instead, felling decisions are made on the basis of each tree's quality and function relative to its neighbours.

What is selective felling?

In CCF, selective felling refers to the selection of individual trees for removal or retention. These decisions are communicated to the harvesting operators through a standardised system of tree marking.

Selective felling concentrates growth on chosen trees, improves overall timber quality in the stand, encourages natural regeneration and maintains a healthy forest ecosystem. Through this process, the forest gradually moves toward a fully irregular structure.

When marking trees for selective felling, foresters assess the needs of individual trees while also considering stand stability, light conditions, forest ecology and wider management aims.

Selective felling may focus on individual trees, or where appropriate, on small groups of trees. The latter approach is referred to as group selection.

Why selective felling is central to CCF management

Selective felling is fundamental to CCF management because it:

- Concentrates growth on retained quality trees
- Increases the overall value of the stand by removing low-grade trees
- Creates space for natural regeneration
- Maintains and enhances the forest ecosystem
- Enhances biodiversity
- Generates regular income for the forest owner

Tree assessment for selective felling

All living trees within a forest stand perform a range of functions, including:

- Contributing to stand stability
- Shaping the vertical canopy structure
- Protecting the soil
- Intercepting rain and slowing the movement of water across the landscape
- Educating and qualifying younger trees towards the productive stage
- Filtering light onto the forest floor
- Producing seed for natural regeneration
- Sequestering and storing carbon
- Providing economic return, at the minimum as fuelwood or pulp
- Supporting the wider forest ecosystem

Some trees provide additional benefits that are particularly valued in CCF. These trees are retained for timber quality (quality trees), biodiversity (bio trees) or other management objectives. Their value may be realised at harvest or they are maintained long-term within the stand, often by selectively removing competing trees.

Quality trees

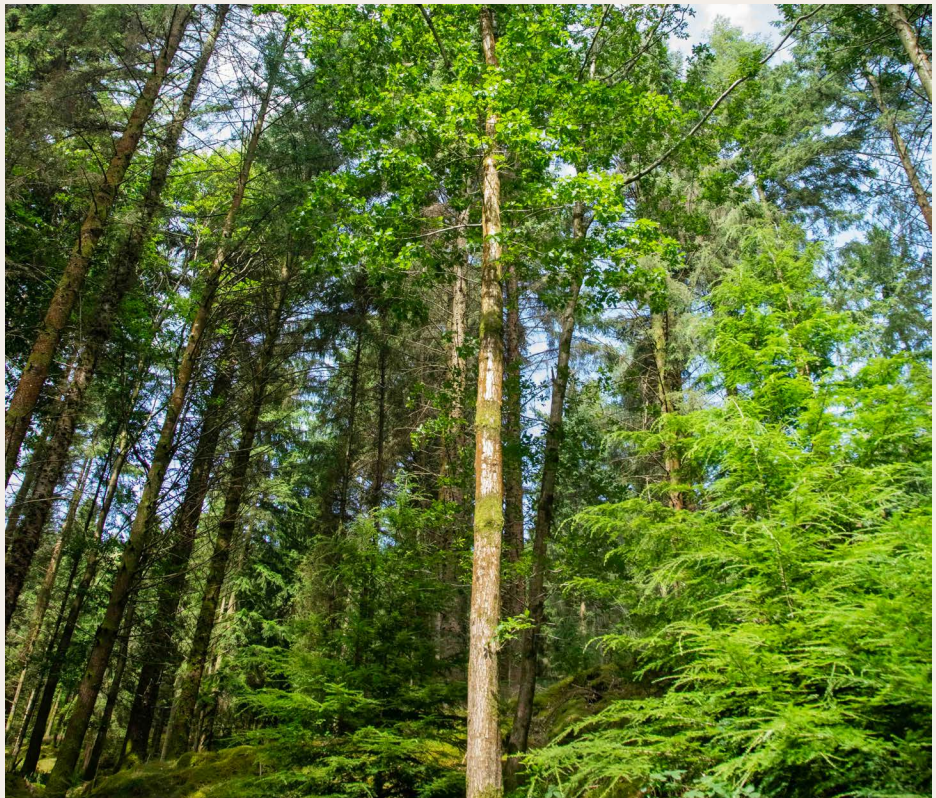
Quality trees are those with high potential to produce future sawlog. Typical characteristics include:

- A straight stem free of heavy branching, forking or spiral grain
- No damage from pests or harvesting operations
- Good vigour
- A strong, balanced crown

Bio trees

Some trees make an above-average contribution to forest ecology and biodiversity. In Irish CCF practice, these are referred to as bio trees. They include:

- **Trees for diversity**. Underrepresented species that enhance current and future species diversity and may serve as seed sources (for example, a broadleaf tree within a conifer stand).
- **Trees of high ecological value**. Trees that provide habitat, food sources or other biodiversity functions, including standing or fallen deadwood and dying trees.



Focus of selective felling operations

Selective felling in CCF management prioritises:

1. Releasing quality trees that have not yet reached target diameter from competition
2. Harvesting quality trees that have reached marketable size
3. Protecting and enhancing bio trees

Trees for removal in CCF management

The health, vigour and growth of a tree are maximised when its crown has sufficient space to develop. As a result, selecting trees for removal generally focuses on identifying the main competitors to a valued tree.

When choosing which competitor or competitors to fell, consider the following:

- **Quality:** Poorly formed or defective competitors are strong candidates for removal.
- **Size and vigour:** The largest, most vigorous competitor generally provides the greatest crown release and yields higher timber volumes for sale.
- **Stability:** Competitors showing signs of instability should be prioritised for removal.
- **Regeneration:** Removing a competitor may improve conditions for natural regeneration in a specific area.

As a final check, consider which tree will deliver greater future value. Retain that tree and remove the one with the lower potential.

For bio trees, assess whether release is necessary. Standing deadwood or cavity trees don't need to be released, whereas underrepresented species most certainly do.

All interventions must be balanced against stand stability and light dynamics; light-demanding species require greater crown release than shade-tolerant species.

Although most removals in selective felling are driven by crown competition, trees may also be removed for other reasons:

- **Infrastructure:** Creating or maintaining extraction racks and headlands for safe machinery access.
- **Safety:** Removing hazardous trees, such as dead trees leaning over public paths.
- **Access:** Removing a poor-quality tree so the harvester can gain access to a tree marked for removal.
- **Wolf trees:** Removing overly vigorous, poorly formed trees (biggest/baddest) that suppress neighbouring quality trees, typically in early thinnings.

In CCF management, there is always another intervention coming. You don't need to remove everything in one thinning.

Crown thinning in selective felling

Crown thinning is the primary thinning method used in CCF management in Ireland.

Crown thinning focuses on the crown of the valued tree. Competition from neighbouring trees for light or space is assessed, and where competition is significant, one or more neighbouring trees are removed. Stand stability and overall light conditions are always taken into account.

Halo thinning is a specific form of crown thinning in which all trees in contact with the crown of a valued tree are removed, creating a clear space around it.

This allows unrestricted crown development until the next thinning intervention.

In CCF management, halo thinning is mainly used as a targeted treatment to release young valued trees, when full release does not compromise stand stability. It may also be applied to release a large, ecological important tree, such as a veteran oak surrounded by younger conifers, provided stability is maintained.

Tree marking in CCF

Tree marking is the method used to communicate selective felling decisions to harvesting crews. Paint symbols are applied to trees to indicate whether they are to be removed, modified or retained and protected during harvesting.

How to approach tree marking

- Work stand by stand, subdividing each stand into smaller units based on terrain or species patterns.
- Where racks or headlands are absent, mark these first, then mark the areas between racks (inter-racks).
- Plan rack layout in consultation with the harvesting contractor, and ensure racks are wide enough to remain usable for future thinnings.
- Consider machinery limitations and the challenges of thinning mixed, irregular stands; some trees may need to be removed primarily to allow safe access or to protect valuable trees from damage.
- Marking can be carried out by one person, but a two-person team improves coverage and decision-making by working up parallel racks.
- When a high-quality or ecologically valuable tree is identified, mark it first to guide surrounding decisions.
- In poor-quality areas, retain the best available trees and rely on regeneration to improve stand quality over time.
- In uniform stands, avoid fixed thinning patterns; identify small features that indicate higher-value trees and thin to favour these.
- In a first thinning of conifers to initiate transformation, full marking is impractical; mark one or two sample racks to guide operators.
- First thinnings in broadleaf stands designated for CCF management are typically marked.

Irish tree marking standard for CCF thinning operations

Pro Silva Ireland has developed a standardised system of tree marks for use by foresters in Irish forests managed under CCF. The system is widely applied in both private and state forests and ensures consistency and clarity across harvesting sites.

The marking system comprises eight categories of marks, grouped into two broad classes:

- **Trees to be removed or modified**, marked with a bright 'hot' colour (usually orange or pink), and
- **Trees to be retained**, marked using a 'cool' colour (white or blue).

These marks communicate clear instructions to harvesting crews and must be visible from multiple directions.

Trees to be retained

(white or blue paint)

Retain on the basis of high timber quality

Retain for quality timber

Quality trees are marked with a white or blue ring around the stem at approximately 2 m height. The mark should be clearly visible from a distance.

These trees must not be damaged during operations.

Quality trees are typically identified early—at first thinning for broadleaves and second thinning for conifers—and favoured during successive thinning operations, although selection can occur at any stage.

The ring mark should be refreshed at each subsequent marking. In areas of high visual or ecological sensitivity, a temporary ribbon can be used instead of permanent paint for the duration of the harvesting operation.

Retain for biodiversity (bio trees)

Retain for biodiversity

These trees are marked with a white or blue triangle on three or four sides of the stem, depending on tree size. The mark should be visible from all directions.

This mark indicates that the tree must not be damaged during operations.

Only trees of very high biodiversity value (bio trees) are marked; it is not necessary to mark every tree with biodiversity features. Typical examples include:

- Veteran trees of diverse species
- Standing deadwood habitat trees
- Trees containing nests or dreys of important species (e.g. red kite, buzzard, red squirrel).
- Underrepresented tree species important for diversity.

Retain to demarcate permanent rack or headland routes

Retain to mark edge of permanent rack or route

Trees either side of permanent racks or headlands are marked with two parallel horizontal lines on the side of the stem facing the route. These marks are particularly useful in older woodlands where rack routes are unclear or where excessive racking has occurred and some racks are being abandoned.

Note, if a rack-demarcating tree later needs to be removed for silvicultural reasons, the retention mark can be sprayed over with a removal mark.

Trees to be removed or modified

(usually orange or pink paint)

Trees selected for removal

These trees are marked at approximately 2m height with coloured diagonal slashes running around the stem and visible from all sides.

Trees are marked for removal to achieve objectives such as:

- Removing poor-quality or defective trees
- Favouring higher-quality neighbouring trees
- Harvesting trees that have reached marketable size
- Releasing regeneration
- Improving structural or species diversity
- Promoting stand stability

Fell

Removal to accommodate harvesting and extraction

These trees are marked with coloured vertical stripes on four sides of the stem. These 'rack marks' indicate the direction of the proposed machine path or rack. These marks are generally only used in a first thinning scenario but may be used in later interventions to extend or adjust the rack network.

Fell for rack

Trees to be ring barked (standing deadwood creation)

These trees are marked with a coloured zig-zag pattern. This mark is used to create standing deadwood by ring barking and is appropriate when:

- The tree is out of reach of the harvest machinery and access is not cost effective
- Harvesting would risk damage to nearby quality or bio trees
- There is insufficient standing deadwood on a site (typically using trees of poor timber quality)

Ring barking should not be carried out close to roads or public walking routes.

Ringbark

Trees for fallen deadwood

These trees are marked with a circular symbol bisected by a horizontal line. This mark indicates that a tree is to be felled and left on the ground. This mark is used where:

- There is insufficient fallen deadwood on the site (poor-quality or overrepresented species are generally used)
- A windthrown tree is interfering with a retained tree but has developed microhabitat indicators. Marking it to become fallen deadwood removes the interference while allowing the tree to continue providing habitat as it decomposes

Fell and leave as fallen deadwood

Trees for standing deadwood (high cut)

These trees are marked with a circular symbol bisected by a vertical line. This mark indicates that the tree is to be cut high to create safe standing deadwood. This mark is used where:

- There is insufficient standing deadwood on a site
- A harvester can safely create a high stump (typically around 4m)

High cuts can be used near paths, as there is no risk of falling branches.

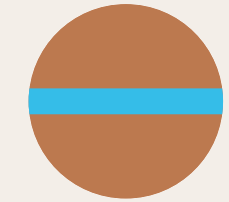
Primarily for use on conifer species, which do not pollard. It may also be used on broadleaves where pollarding is beneficial, for example:

- To increase vertical structure diversity
- To suppress side branching on neighbouring quality trees
- To provide temporary support to a broadleaf tree with a poor stem-to-crown ratio, which would otherwise become unstable if fully released

Fell (cut high) and leave as standing deadwood

Irish Tree Marking Standard for CCF

Trees to retain — Blue or white paint

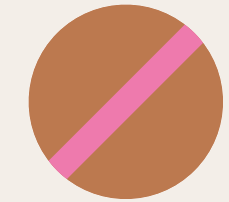


Retain for quality timber

Retain for biodiversity

Retain to mark edge of permanent rack or route

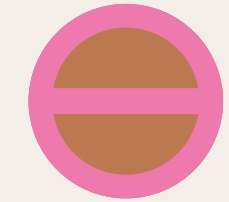
Trees to remove — Pink or orange paint



Fell

Fell for rack

Ringbark



Fell and leave as fallen deadwood

Fell (cut high) and leave as standing deadwood

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Glossary

Bio tree In Irish CCF, a tree of high biodiversity value.

Crown The main body of upper branches and leaf/needle material of a tree.

Education In CCF, education describes how the proximity of young trees to one another promotes straight stem formation, upward growth and reduces side-branching.

Even-aged In the context of Irish forestry practice, even-aged refers to tree communities that were established/planted at the same time. As a result, all the trees are the same age.

Inter-rack The area between racks. Sometimes referred to in marking as “the selection”, as it is the area where trees are selected to remove or retain based on their relative value, as opposed to the rack, where all trees in the row are removed to create the rack access.

Qualification In CCF, the suppression of side branching in pole stage or high canopy trees by species in the lower canopy.

Quality (Q) tree A tree of high quality for future sawlog.

Racks Routes in the forest that facilitate harvest and forwarding of timber. Usually created by removing a row of trees along the orientation of the original planting lines and spaced at widths conducive to working the forest in the context of the chosen management system.

Release The freeing of a quality or desired tree from competition with a neighbouring tree or trees by the felling of one or more of the neighbouring trees.

Sawlog Roundwood logs that are large enough to saw for lumber.

Selective felling In Ireland, selective felling refers to the selection of trees for removal or retention in CCF management.

Stand A forest stand is a recognizable management unit by species composition, age or physical features.

Target diameter The diameter at which a tree meets market requirements for sawlog, varying by species and buyer.

Transformation The gradual conversion of an even-aged stand into an irregular, species-diverse CCF forest.

Veteran tree Large, old trees that display many microhabitats. Veterans have high ecological value and are often selected as bio trees in tree-marking operations. In addition, veterans may also be important sources of seed for regeneration or act as key anchors in the forest in relation to stability.

Harvesting and thinning

In CCF, harvesting refers to a felling operation that generates sawlog, whereas thinning is a felling operation that releases quality and desired trees.

In the transformation of younger, even-aged plantations to CCF forests, initial felling interventions take the form of a thinning, until the forest matures enough for operations to incorporate the harvest of more valuable trees within the ongoing felling cycle.

In a developed CCF forest, felling interventions combine both harvest and thinning in one operation, as many age and size classes are present all at once.

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
- Understanding CCF transformation
- Enrichment planting in CCF
- Light forest operations
- Guidelines for CCF harvest operations
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