

## Pro Silva Ireland Webinar – Transforming Irish Forests – 8 Sept 2020

Response to Questions from participants at the Webinar:

### Question 1: CCF?

**Ted Wilson:** CCF refers to Continuous Cover Forestry. It is a distinctive approach to sustainable forest management. Here are some definitions:

*“...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](#)

*“While CCF is not a silvicultural system per se it can be implemented using various silvicultural systems that do not involve clearfelling.”* Yorke 1998

There are several guiding principles:

- Managing the forest ecosystem
- Using natural processes
- Working within site limitations
- Diversifying stand structure

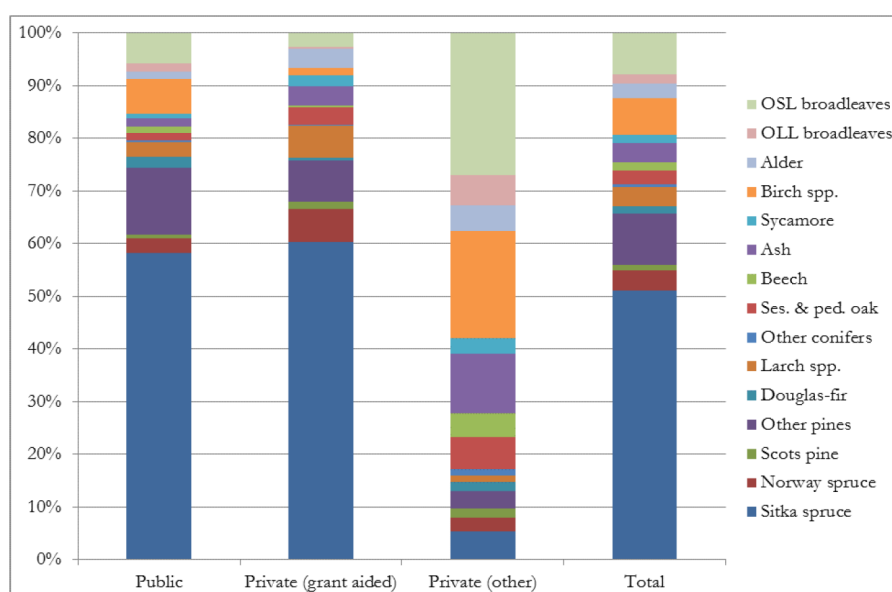
An alternative name for the approach is Close-to-Nature Forest Management. This term is especially common in much of the European and North American.

CCF can be applied in any forest type: mixed, broadleaf, conifer.

The most significant organisations dedicated to CCF are [Pro Silva Europe](#) (1989), [CCFG](#) (1991), [Pro Silva Ireland](#) (2000).

### Question 2: Is the Sitka spruce mostly under the ownership of Coillte or across the ownership pattern?

**Paddy Purser:** Across state and private owners:



Proportion of stocked forest area by ownership and species group. Source: [Ireland's National Forest Inventory 2017: Main Findings. \(Government of Ireland 2018\)](#)

### **Question 3: Are you creating permanent access rides to fell to?**

**Comment from participant:** That's what I find hard in late transformation separating the operational racks with the regeneration so tend to go for an irregular system.

**Reply from participant:** If the racks are far enough apart Jackie then I find that this is not an issue (minimum 16m but best around 20m in my experience) -then loss of regeneration on racks is less of an issue.

**Ted Wilson:** An operational aim in CCF is to create semi-permanent or permanent access to the stand. This helps minimise the risk site damage, and separates the regeneration and operational activities. Protecting the racks from damage is important at each stand intervention, so we look to use brash mats, consider the timing of operations, and ensure drains and other infrastructure are well maintained (especially on gleys). In the graduated density thinning (GDT) treatment, outlined in the presentation, you will see that regeneration and operational functions are separated by the 2-step approach to racks in thinning 1 and thinning 2. In GDT we work with 1 rack every 8 rows (1-in-8), which is approximately every 16 m. So long as the site is suitable, slightly wider rack spacing up to 20 m might be considered so that overall impact of harvesting equipment is minimised.

Width of the racks is another consideration. With planting spacing at 2 m, the racks are normally around 4 m wide. This can be tricky in some situations, especially when the trees become increasing large at the advanced stages of transformation, i.e., the racks start to get increasingly narrow. Also, slopes and uneven ground are potential problems. A narrowing rack and uneven ground increases the risk of the harvester or forwarder abrading trees as they travel up and down the rack.



Retired rack in the TranSSFor graduated density thinning (GDT) treatment. From the second thinning, there is separation of the operational and regeneration activities. The retired racks provide a suitable environment for natural regeneration. You can see operations racks on the left and right of the image. A modern harvester has little difficulty reaching trees with racks at 16-20 m spacing.

**Question 4: What age are the SS spruce starting to cone in Ireland and is there a difference with Super Sitka?**

**Reply from participant:** Coning starts from around 23 years, sometimes earlier, but is not reliable until around 30 years plus.

**Ted Wilson:** At Ballycullen (P95) we have recorded significant cone production from stand age 23. There was certainly seed production at an earlier age. At Fossy Hill (P92), we found well-established seedlings in 2018 (stand age 25-26). These were mostly found in larger gaps, and especially in a wind-blow area within one of the experimental plots.

In 2019 we had a particularly heavy mast year, presumably a response to the prolonged dry summer in 2018. The literature suggests a range of ages for the start of cone production. For example, Peter Savill's last book, [\*The Silviculture of Trees Used in British Forestry\*](#) (3<sup>rd</sup> edition, 2019), states that the earliest age at which the tree bears seed is 30-40 years. The [\*Forestry Commission Operational Guidance Booklet 7 \(OGB7\), Managing Continuous Cover Forests\*](#) (2008) suggests seed production from 25-35 years. Clearly our experience is that significant cone and seed production can occur sooner than reported.

Nonetheless, seed production is only one of the critical components of achieving natural regeneration in a stand. You need:

1. Seed production
2. Receptive seed bed
3. Conditions for germination
4. Conditions for seedling development
5. Control of competing vegetation
6. Control of browsing animals (especially deer)

Note: Requirements for germination and seedling development are different.



Sitka spruce cone development (16 May 2019) on a tree at Ballycullen Forest. The parent tree was planted in 1995. In this case the reproductive bud was initiated in 2018 after the prolonged dry summer. On the cone (strictly speaking a megagametophyte strobili) to the right in this image you can see the pollen grains (originating from the male pollen cone (microgametophyte strobili)). From this point the seed will be pollinated and the cone will continue to develop and mature during the growing season. Seed produced from these cones will be dispersed and germinate during the 2020 growing season.





A cluster of Sitka spruce cones at Ballycullen Forest, August 2020. Most of these cones would have been initiated in 2018 and matured over the 208, 2019 growing seasons. Beside the cones, you can see germinants of seedlings. Throughout the experimental sites we are recording significant numbers of germinants, but light levels are likely still too low for these to persist and develop into seedlings.

We will be reporting details of cone production and seedling establishment as part of the TranSSFor study. Indications are that reproductive potential is relatively high, and from an early age in stand development. However, we need to take into account basal area (BA). BAs are still very high throughout the research plots, so we would not expect the light levels to be suitable for seedling development (except in a few of the larger gaps we already have, by accident or design). OGB7 (page 27) suggests critical basal areas for germination to be 30-35 m<sup>2</sup>/ha and for seedling development to be 25-30 m<sup>2</sup>/ha.

**Question 5: Is there support available to switch to CCF?**

**Reply from participant:** The Forest Service have a CCF grant scheme.

See link to [Woodland Improvement Scheme – Continuous Cover Forestry](#) (DAFM).

An excellent summary of the requirements and funding package is provided on this link by [Teagasc](#).

**Ted Wilson:** We have published a recent paper that provides an update on developments in CCF here in Ireland. This reviews the policy, grant and training activities currently taking place. The report is available on this link [here](#). (If there is a problem downloading the report, please get in touch for a copy.)

**Question 6: I have a very windy site. Is that suitable for CCF?**

**Ted Wilson:** This is an important question but not easy to respond to with a clear answer. It would be impossible to give advice without more information about the site and its management history.

Some of the critical site attributes include: soils, drainage, aspect and elevation, topographic exposure.

Some of the critical stand attributes include: establishment practices, species, spacing, current stand age, thinning history.

Precise guidelines are not currently available, however, in theory CCF can be practiced on a wide range of sites, including relatively windy or exposed conditions. At the early stages, guidance would be similar for thinning an even-aged stand under the clear-fell system.

In terms of tree biology, rooting depth and stability of the stand are vital. For this we need to consider the soils and drainage, and also the development of independent stability within the stand. This is best achieved by initiating the thinning from the earliest opportunity after the establishment phase (i.e., after 15 years). On productive sites, there should not be a delay in starting this process, as the trees start to grow tall very quickly. Thinning any stand always introduces some element of risk to stand stability, but by starting the process as soon as possible we can reduce the likelihood of significant failure later on.

Thinning has the effect of giving trees more room to grow, but it also encourages trees to develop independent stability by allocating resources (carbohydrate from photosynthesis) to stem and root strengthening. Trees with larger and healthy crowns are better placed to do this, due to their relatively large leaf area. This is another reason for not delaying thinning; if thinning is delayed then the crowns become reduced in size due to competition with neighbouring trees, and the ability of the tree to respond to thinning is delayed. In some of the literature you might see the term “frame tree”. These tend to be dominant trees with healthy crowns. These trees respond quickly to thinning and help to stabilise the whole stand in the face of strong gusts of wind.

Ultimately, there is an element of risk management and risk reduction required in terms of CCF on windy sites. Good thinning practice is essential for all stands being transformed to CCF, but is especially important where the site is exposed, or where the soils are wet/poorly drained. My personal view, is that this is a good reason for exploring the CCF grant scheme, thereby accessing professional advice/assistance with the decision process related to your site. CCF on windy sites, or more generally in response to wind, would make a good discussion for a future webinar or Pro Silva Ireland event.



Root development on a dominant tree in the TranSSFor study site at Ballycullen. The primary roots are well spaced and uniform around the base of the stem. The stem is standing straight without any sweep. Seedling quality, planting practices and site preparation all influence the potential for a tree to develop a uniform distribution of primary roots as it grows to maturity. Starting the thinning interventions from an early stage (post the establishment phase) stimulates the development of these structural elements of the tree.

**Question 7: Is there any indication on which treatment is showing the greatest stability to windthrow. Wind-throw is always wheeled out as the first reason against trying (sadly)...I'd be interested to hear from both of you on this...experiences from Ireland..and where the research is leading?**

**Ted Wilson:** There is a large body of research on wind effects in forests, especially in Sitka spruce forests. Most of the research has been undertaken in the UK by Forest Research. They have produced a software package called ForestGALES that is the state-of-the-art in terms of an operational tool. However, this is really a tool for managing even-aged production forest stands. There is a lot of discussion and ongoing research on developing the software/decision support tools for stands being managed on CCF principles, but at the moment there is a deficit of suitable data to validate the models on which the decision support tool depends. We are in discussion with Forest Research about sharing data from the TranSSFor project to work on this issue. In fact, the TranSSFor sites are the most advanced examples of stands under early transformation where reliable and detailed tree growth data is available.

Regarding our research, we will be reporting on some aspects of wind adaptation in the three thinning treatments, and at each of the sites. One important parameter is height:diameter (h:d) ratio. This can be determined and monitored in each tree in our plots. We have measured the diameter of each tree in all 18 plots in 2010, 2014 and 2018/2019. We have also undertaken samples of heights across all size classes in each plot. In 2019, we did an especially large sample of heights and are using a model provided by Forest Research to give the best possible estimates of height for each tree the study. From this we will generate actual and estimated h:d ratios for each tree.

Most important are the dominant trees. As explained in an earlier question, these trees are critical for overall stand stability. Where h:d ratios are below 80, we expect individual trees to have an appropriate level of stability to withstand most windstorm events. This can then be used to assess overall stand stability. However, bear in mind that a complete assessment of the stand would include site and soil factors, as previously mentioned.

In short, we expect to report as part of the TRanSSFor project quite a lot of information about changes in stand development and parameters associated with tree stability.

For more on wind issues in Ireland, perhaps the best paper to start with is a COFORDS Connect publication, [\*Understanding and managing windthrow \(2018\)\*](#), by Áine Ní Dhubháin and Niall Farrelly.

**Question 8: How much CCF is there in Ireland and what interest is there amongst owners?**

The best reference is this: [\*Vitková, L., Á. Ní Dhubháin, P. Ó'Tuama and P. Purser. 2013. The practice of continuous cover forestry in Ireland. Irish Forestry 70\(1/2\): 141-156\*](#)

However, I think there is consensus that the area under CCF management is changing rapidly. Vitkova et al 2013 provided an estimate of the forest area being managed under CCF. I think it is safe to say that currently we are still managing under 5 % of the total forest area on CCF principles. There are some major factors at play:

1. Private sector:
  - a. New CCF grant scheme (2019) has proved successful and popular. This went through a successful pilot phase in 2019, and is now more widely open to woodland owners. It covers woodland areas up to 10 ha.
  - b. SLM Fund. This fund is an green investment fund that is undertaking a CCF project in Ireland. The area of woodland under management is increasingly rapidly.
2. State sector (Coillte)

- a. Bio Forest project. This project is identifying a range of sites across the Coillte estate where conservation and biodiversity can be promoted. CCF is an important strategy within this project. It is likely that there will be an increasing area of the estate included within CCF management plans.
- b. Coillte Nature. This is a new not-for-profit organisation that is primarily focused on managing woodlands in the area around Dublin. At present 900 ha of woodland in the Dublin Mountains have been transferred to Coillte Nature. Most of this is going to be transformed to CCF.

In terms of interest, there is a lot of interest from woodland owners. Teagasc Forestry Development Department is actively organising events and training projects to support demand for more information from woodland owners. Jonathan Spazzi (Teagasc) and Padraig O Tuama (CCF Management) are running the initial courses in broadleaf CCF this year. Marteloscopes (CCF training plots) have been set up in various locations for conifer and broadleaf; this is an expanding network.

**Question 9: Ted, has there been any research in Ireland on the response of woodland flora and fauna to CCF management in commercial plantations in Ireland?**

**Reply from participant (Paddy Purser):** There are a series of demonstration stands recorded and monitored under the [French / International AFI protocol](#) where biodiversity indicators are recorded. Monitoring is on a 5 year cycle - most stands have had 2 measurements at this stage.

**Ted Wilson:** This is a very important question. As Paddy explains, there is a network of [AFI Research Stands](#) in Ireland. The protocol incorporates a wide range of parameters related for structure, development and production; also included are biodiversity indicators. Reports are produced on a 5-year cycle and add to data collected from stands across Europe.

One of the main claims for CCF is that it supports and promotes woodland flora and fauna. However, as far as I am aware, there is not yet a major research study taking place to address this question; certainly, it does not feature in the current phase of the TranSSFor project. A recent [report](#) (July 2020) on biodiversity values in productive forests was recently published by Confor in the UK, but it makes almost no reference (unfortunately) to CCF.

Nonetheless, even though our research stands are very young, we are seeing some remarkable developments. Already, we are seeing birch, sycamore, ash and oak seedlings coming into our research plots. These are arriving by completely natural means. The numbers are very low, but it indicates that if we create gaps and appropriate light conditions, there will almost certainly be increased tree diversity as these forests develop.

In some of the more advanced examples of CCF in Ireland, where there is more than 20 years of active management, there is a lot of evidence of increased tree species diversity and habitat provision. By avoiding clear-felling, we do not impose an ecological “re-set” on the forest. Some of the features we can encourage with time is the accumulation of down woody debris, and standing dead stems. Both these features are associated with mature woodlands, and can easily be incorporated in the management of a continuous cover forest.

In terms of research, there is a lot of opportunity to undertake additional projects using the TranSSFor sites (especially into the future). One limitation might be the relatively small size of the plots. An additional option would be to undertake research in other operational stands across Ireland. Coillte has recently been evaluating the biodiversity potential/importance of their estate. This might provide a foundation for future research.





CCF and species diversity in Ireland. This stand has one of the longest records of active transformation in Ireland. The overstorey is primarily composed of Douglas fir. However, within the understorey there are at least 12 species of trees. This regeneration can be actively managed into the future to promote those for timber and economic values, and others for their biodiversity value. A principle of CCF is to maintain species diversity. Along with this diversity comes the associated diversity of other flora and fauna. This particular stand is part of the Irish network of AFI Research Stands; biodiversity attributes have been actively monitored since 2012.



A standing dead stem (snag) incorporated in to a stand being managed under CCF principles, Coombs Wood, Cumbria, England. A popular name for these features is a “bug hotel”. You can see from the profuse regeneration in the gap, that snags can be readily incorporated into the managed stand. Such features make a significant contribution to the biodiversity value of a managed woodland.



**Question 9a: Are Irish stands included in [the AFI network] and what are the biodiversity indicators?**

**Paddy Purser:** There are 9 different Irish stands in this - the indicators are standing deadwood, fallen deadwood, tree microhabitats, tree based flora, density of natural regeneration - there is a desire to add more to this.

**Ted Wilson:** Yes, the network includes Irish stands. The details of the survey protocol are included in this excellent publication (that also provides principles of stand management and many case studies from stands within the network, but no Irish examples):

Susse, R., et al. 2011. [Management of irregular forests: developing the full potential of the forest.](#) Association Futaie Irrégulière, Besançon, France. 144 p.

Thanks to Jackie Dunne for recommending this excellent book to webinar participants.

This book can be recommend widely. It is one of the best texts on the nuts and bolts of CCF, with excellent guidance on the process of tree marking. The examples are all from France, but it does demonstrate the potential of the approach for Ireland.

**Question 10: I definitely feel that good CCF management needs more ongoing input of forestry husbandry but then marketing to stem diameter, the benefits to the land and the ongoing regeneration of the wood without masses of herbicide is fabulous.**

**Ted Wilson:** There is a great deal of opportunity for nature-oriented solutions. Reducing chemical inputs is important, and increasingly expected from certifiers of sustainable forestry. Husbandry is something we see in European forests, and has potential within CCF systems, but it requires a careful/cautious approach. There is a time and cost commitment to ensure that there is a benefit to the forest. It also requires a lot of experience – most of the examples in Europe are bedded within deep cultural traditions for woodland/land management. The key is ensure that the regeneration potential of the forest is not adversely impacted, and to protect the most valuable stems.

**Question 11: Interested in tree marking but also in individual tree monitoring using GIS, satellite and drones. Thinking that knowledge based on real time over decades is worth funding?**

**Ted Wilson:** As Liam so eloquently explained, tree marking is undoubtedly the link between the science/policy/planning dimensions of CCF and successful practice. We do not see a way of automating the function of tree selection, at this point in time. And we also recognise some of the challenges that a harvester operator might experience. To make a proper assessment of a tree, you need to be able to assess its total condition, the stem form, the crown, its competitive situation, etc. There are simply too many site and tree attributes to consider. You also have to take into account the “two step” selection of the “Q-trees” (what we might call a positive selection) and the trees that are ready or need to be removed (the negative selection). This can only be done by a qualified or trained tree marker, on the ground. From a harvester cab it is both difficult and impractical. So there are definitely “on the ground” requirements for separating the functions of tree marking and harvesting.

In the TranSSFor project we have completed drone flights both before and after the latest thinning interventions at both of the research sites. We have also completed some preliminary work using LiDAR. This remote sensing data will have most significance as the forest develops on to the next and subsequent thinning interventions, especially in terms of individual tree development (leaf area, biomass, carbon, etc). We can use this data to assess overall structural develop of the stand.

There is work ongoing elsewhere on remote sensing applications. However, I am not aware of this work filtering through into practice. It would certainly be useful to calibrate remote sensing images for different stand conditions, stages of transformation.

**Question 12: Thanks Ted. You said you are a year away from formal results - are there any indications that CCF can outperform clear fell in Irish conditions?**

**Ted Wilson:** As I said in the webinar, a definitive answer to this question would be the “Gold Ticket”. For most foresters, I suppose, “outperform” refers to production output from a stand. However, I have learned very quickly that the reason we cannot be definitive is because it is far from a simple question to answer. At the moment the best we have are models, but in the absence of good data, there has to be a big note of caution applied to most information we might read. This will apply to the modelling work we are proposing for the final part of the TranSSFor project, later this year.

In theory, I would say that CCF has a number of advantages. You maintain full occupancy of the site. You can more effectively use canopy space. So, for example, while a canopy tree is receiving full light and racing to its target size, individuals at lower levels are growing in the “waiting room” and ready to sprint once the overstorey tree is removed. In terms of economic performance there is a saving in terms of establishment costs. And there is no gap in time, as in the clearfell system, between harvest and re-establishment of the next rotation.

In terms of wider environmental parameters, including water and nutrient conservation, carbon capture and storage (especially in the soil), habitat and biodiversity, and social values, I would say that CCF outperforms the clearfell system. But it really does depend on site and other conditions of management.

One key consideration is that there is a distinct difference between a stand in transformation and a transformed forest. At the moment, everything we have in Ireland is “in transformation”. That means we are taking even-aged plantations and re-configuring them. As the TranSSFor project demonstrates, there is not yet a reliable understorey of seedlings, and it will be several decades before we achieve the “steady state” of harvesting high quality trees and releasing trees from the waiting room.

One economic advantage of transformation is that, in the early stages at least, we are likely to see slightly higher quality outputs, a consequence of crown thinning, which for some owners may be a welcome financial benefit.

There are a few attempts to compare the performance of a different silvicultural systems. A good example was published by [Forest Research](#) (2014) that compared four forest management scenarios.

A very helpful paper in [Irish Forestry](#) offers one of the commentaries on this issue:

Purser, P., P. ÓTuama, L. Vítková and Á Ní Dhubháin. 2015. [Factors affecting the economic assessment of continuous cover forestry compared with rotation based management](#). Irish Forestry 72 (1 and 2): 150-165.

Something that I believe is missing from a lot of the research on CCF, and comparisons with other systems, is an emphasis on timber quality. CCF offers not just an opportunity to improve the environmental status of the managed forest, but also to take much greater control of the timber being produced. The art and science of tree marking are absolutely fundamental to this. The fact that the trained tree marker is looking carefully for the best trees to promote, from one intervention to the next, will have a long-term benefit in terms of the economic performance of a stand.

Ultimately, the decision to adopt CCF is not simply a “performance” or economics issue. It has a lot to do with the owner’s objectives, especially medium and long term goals, as well as their philosophy in life. My research and wider experience, tells me that a well-managed CCF forest will continue to generate positive cash flows at regular intervals, while sustaining many other ecosystem services. Of course, for Sitka spruce in Ireland there are still lots of questions and technical considerations, but there is no reason to suspect the established principles cannot be applied here.

**Question 13. From the latest [Confor publication on biodiversity in forestry](#) (page 16): “In many upland forests thinning and CCF is impossible due to windthrow risk, although it is easy to find the fallen stands of optimistic foresters who tested its limits.”**

**Ted Wilson:** I would like to thank the questioner for this contribution. I read this report and was disappointed that the author did not engage more seriously with continuous cover forestry, or active researchers/practitioners. Certainly there are limits within which any silvicultural approach will work, and where one system is more suitable than others. The “thinnability” of forest stand is certainly a critical consideration. However, I was almost go as far to say that if a stand is beyond the safe practice of thinning, then perhaps we are not doing forestry on the most appropriate sites. Without an ability to do thinning, at the correct point in a stands development, there is very little opportunity to do anything other than produce biomass. Competition processes within the stand will lead to stem differentiation into dominant, codominant, intermediate and suppressed classes, but the risk of catastrophic failure will preclude quality enhancement, in most cases.

In Ireland, we already have a good idea which sites will be most successful for CCF. These are sites on well-drained mineral soils, brown earths, etc. They are sites that are thinnable. Within this range, there is a very large potential for the application of CCF, without necessarily “testing to the limits”.

Another point of caution about the report from Confor is a comment made about production and biodiversity. A paper by [Bianchi et al](#) (2020) is cited. However, again, reading the fine print is important. This paper is based on a modelling exercise that does not incorporate tree quality parameters and is based on practices in Scandinavia.

Overall, it strikes me that the Confor report underplays the potential role of CCF and focuses more on arguments in support of conventional rotational forest management.

**Question 14: In your research did any of the sites use animals in a time controlled manner to kickstart regeneration? I'm thinking of pigs to turn over the brash, dig up the seed bank and help new native trees germinate, cows, sheep or goats with their manure and grazing to help germinate more grasses and forbes to develop a fully silvopasture system? This of course needs to be managed time wise very carefully.**

**Ted Wilson:** This is an extremely interesting question, and it relates to comments earlier (see question 10).

The short answer to this is that the TranSSFor project is not considering silvopastoral factors. This would require a much larger study and study area to deliver. We are mostly looking at stand structural development, tree adaptation to site and wind, timber production and quality, natural regeneration.

There is an important role for agro-forestry in Ireland, and I am certainly interested in seeing more work in this area. I do not claim to be an expert or especially knowledgeable, so I would defer to Dr [Ian Short](#), Teagasc, who has been active in this area for a number of years. You might be aware that there is a [grant scheme to support the expansion of agroforestry](#).



As I noted earlier, correct application of a silvopastoral system is potentially quite complex, and where they have been most successful would be in environments and cultures where there are very well established traditions. Much as livestock might benefit from access to a woodland, there are risks of damage to the trees and vegetation, so it would be a case of proceeding with caution. A dedicated pilot or research project might be a good starting point.

**Question 15: Is a felling licence still required for CCF system?**

**Paddy Purser:** Yes, a felling licence is required for CCF.

**Question 15a: Can a felling licence be obtained faster if going with a CCF system?**

**Paddy Purser:** Not necessarily – it depends on location.

**Question 16: Are the seedlings in CCF regenerated naturally?**

**Ian Short:** The seedlings normally come from natural regeneration but that is not an absolute requirement of CCF. Underplanting can also be done as well.

**Ted Wilson:** The CCF community certainly promotes natural regeneration as being the most desirable pathway for forest renewal. When you see the seedlings coming into the stand it is an indication that the forest is working in the right direction. However, this does not preclude the introduction of other seed sources or species. With climate change, there is a lot of discussion about the role of seed from sources that match our predicted future climate. There is also very strong evidence for the benefits of mixed species stands in terms of nutrient cycling, soil amelioration and habitat. Therefore, underplanting is an option. There are no hard and fast rules. However, it is only worth making the investment in planting seedlings if you are relatively certain that are going to survive. Each species works within a range of light tolerances. If you plant a light demanding species in a shady area, then you are likely to see high levels of mortality. Understanding the light requirements and the link with forest gap size are essential. It might require a tentative trial and error approach, before you make a significant investment in planting stock.

**Question 17: Are there any concerns about producing larger sawlogs - can the sawmill sector cope with large logs?**

**Ted Wilson:** I may not be the best qualified to respond to this question, however, I would say the sawmill sector is responding. Most of the sawmills in Ireland are capable of handling a range of timber sizes, including some of the larger grades. Where the volume producers might have difficulty is setting up for small parcels; this is where some of the smaller mills are able to take advantage.

The issue about sawmilling has been discussed in other places, especially in the UK, in recent years. However, simply as a function of forest restructuring and the need to manage the increasing volumes of home timber coming to market, there are going to be more large-dimension logs coming to market. It is only logical that the mills should respond and take advantage.

**Question 18: Is there any advantage of continually pruning regenerated seedlings**

**Ted Wilson:** Pruning is an interesting question. In my view we should be concentrating efforts on the best quality trees. A straight, clean stem offers the best potential for a good market return. Selective pruning is not difficult, and may not be especially time-consuming. For the owner of a small woodland it makes a nice weekend activity. The cost of a good quality pruning saw is a worthwhile investment in my view. It is worth reading guidance, not starting too soon and taking care not to damage the bark of the tree close to the branch union with the stem. Also, avoid removing living branches as this can reduce the leaf area and productive potential of the tree.

On a recent Pro Silva Ireland study visit to the Alsace, we saw first-hand an active pruning programme in Douglas fir stands. The foresters there were very strong advocates for pruning. However, there is a major differences between France and Ireland at the present time, in that French foresters have ready markets for superior grade, large dimension and knot-free timber. Here in Ireland there is less product differentiation in the sawlog market. But if there were more people producing high grade timbers into the future, I am certain the value-added potential will be realised. We always need to look to the future, and remember that wood, with all its many uses, is only going to be more important. This especially true for home-grown material.

Teagasc provides further guidance on this topic: [High pruning of conifer and broadleaf trees](#).

Also, there is a nice paper in Irish Forestry: Fitzsimons, B. `1989. [Pruning conifers in Ireland](#). *Irish Forestry* 46: 29-42



A pruned stem of Douglas fir, Alsace, France (2018). The trees with best potential to produce high quality timber are selected and then pruned. In this case the pruning is done up to a height of 10 m, using a tree climbing rig. It is more common to see pruning to around 6 m using a hand tool with an extending handle. This image was taken during the Pro Silva Ireland study tour in 2018, which included the opportunity to shadow a team of tree markers from the French Forest Service (ONF).

#### **Question 19: What species will be used to diversify stands?**

**Ted Wilson:** A wide range of conifers and broadleaf species will work together in CCF systems. We are seeing Sitka spruce work with Douglas fir, but there are many options. Balancing the various ecological requirements of each species is very important. There is a recent review for Ireland:

Keane, M, B. Mason and A. Pfeifer. 2018. [Species Mixtures in Irish Forests](#). COFORD, Department of Agriculture, Food and the Marine, Dublin.

**Comments from participant Hp (active in the transformation of a 77 ha Sitka spruce woodland in the UK):** I would recommend for future cashflow to bring broadleaves as early as possible into a Sitka spruce stand because of climate change.

**Question 20: As an early climate change researcher studying pine weevil and forecasting its emergence into future climates, I am wondering when you spoke of building "resilience" against pests and thinking of the phasing out of pesticides coupled with climate change effects too into the future, what place do you feel CCF would have in this dilemma in terms of IPM.**

Ted Wilson: In general, increasing the diversity of our forests is an important adaptation strategy in the face of climate change, introduced pests and diseases. This structural diversity will be at the vertical and horizontal levels within stands, and also across forested landscapes. Species and structural diversity together should increase the ecological resilience of our forests. In terms of Sitka spruce, we can increase resilience by wider use of mixtures and CCF, both of which are topics under discussion at national and international levels.

Hand-in-hand with re-structuring the forest estate, there needs to be far greater vigilance when it comes to bio-security. We only need to look at ash dieback and the impact it has had to appreciate the risks from importing planting stock, soil or untreated forest products. Being an island brings some protections for Ireland, but in this globalised world economy we have to ensure that our regulatory and inspection capacity is sufficiently robust and resilient.

Pine weevil (*Hylobius abietis*) is an interesting subject. My understanding is that virtually all spruce forests host a resident population of this species. Most of the time there is no problem, as the background population of the weevil is able to feed and sustain itself without causing significant damage to a productive growing stand of spruce trees.

The problem only arises when we clear-fell the stand. At this point there is a dramatic change in environmental conditions. The cut stumps of spruce trees and ground conditions provide a perfect habitat for a short-term explosion in the weevil population. Countering this depends on leaving the site fallow for a period until the population subsides, and also the application of chemical treatments on the newly planted seedlings.

In CCF, we never encounter the conditions responsible for *Hylobius abietis* population explosions. The weevils are present, but only in low numbers, and they simply operate as part of the biodiversity within the forest ecosystem. The shady conditions in the forest floor of a CCF stand may also bring some protection to seedlings as they regenerate, which is quite different from the open environment on a clear-fell site. Natural regeneration within a CCF system is rarely limited by weevils, certainly not in my experience.

It strikes me that the issue with *Hylobius abietis* is a strong argument for more CCF, both in terms of environmental and economic reasons. However, I would add that my expertise in this area is limited, and I would recommend discussing this in more detail with more qualified researchers/specialists.

**Question 21: Can conversion of a Sitka spruce stand to native broadleaf work with CCF and natural regeneration?**

**Paddy Purser:** This is happening in many cases but it is a long, very long process.



**Ian Short:** Conversion of SS stand to native broadleaf using CCF and natural regeneration may be difficult as a seed source for the broadleaf species will be required. Careful management of the SS canopy to provide sufficient light will also be required.

**Ted Wilson:** the TranSSFor project is focused on relatively young stands, planted in 1992 and 1995, respectively. We have recorded very low numbers of birch, sycamore, oak, holly and ash within some of the research plots. So, one way or another, seed does find its way into these woodlands, even when there is no obvious seed source, or deliberate attempt to encourage natural regeneration with native species. As Paddy and Ian have said, natural mixing just happens, and should perhaps be actively encouraged. Whether this is the best way to achieve increased native woodland cover is questionable.

**Comment from Christian Brennan : The objectives and vision of the forest is down to the forest owner.**

**Ted Wilson:** Thanks for this comment, Christian. This is absolutely true, but it also important for there to be a dialogue between the professional practitioner and the owner so that they have the best information to make a sound decision. In this regard, I would like to acknowledge the work of Teagasc Forestry Development Department, the Association of Irish Forestry Consultants and all involved in the Forestry Knowledge Transfer Groups, for helping get the message of forestry to woodland owners, and for stimulating a lot of positive interest in forestry at the present time.

On a personal note, to end this feedback paper, I would like to extend my thanks and gratitude to Pro Silva Ireland. This small by dynamo of a volunteer group has delivered an incredible service in terms of engaging both foresters and woodland owners with all the issues relating to continuous cover forestry. We are all on a journey together, in a partnership of learning, which is what I think makes forestry so interesting and important for the future.

### **Further Reading**

Several reports and articles have been produced by members of the TranSSFor project team. Research papers with results from the latest phase of the transformation will appear between 2020 and 2022.

1. Wilson, E., Ní Dhubháin, Á. and Short, I. 2020. [Transforming Sitka spruce plantations](#). *TResearch* 15(1): 32-33.
2. Wilson, E. R., P. O Tuama and J. Spazzi. 2020. [Continuous Cover Forestry in Ireland: update on recent developments and initiatives](#). *CCFG Newsletter* 41 (Winter 2020): 71-77
3. Wilson, E., I. Short, Á. Ní Dhubháin and P. Purser. 2018. [Continuous cover forestry: The rise of transformational silviculture](#). *Forestry Journal* 288: 38-40.
4. Wilson, E., I. Short, Á. Ní Dhubháin and P. Purser. 2018. [Transforming Sitka spruce plantations to continuous cover forestry](#). *Forestry & Energy Review* 8(1):38-40