

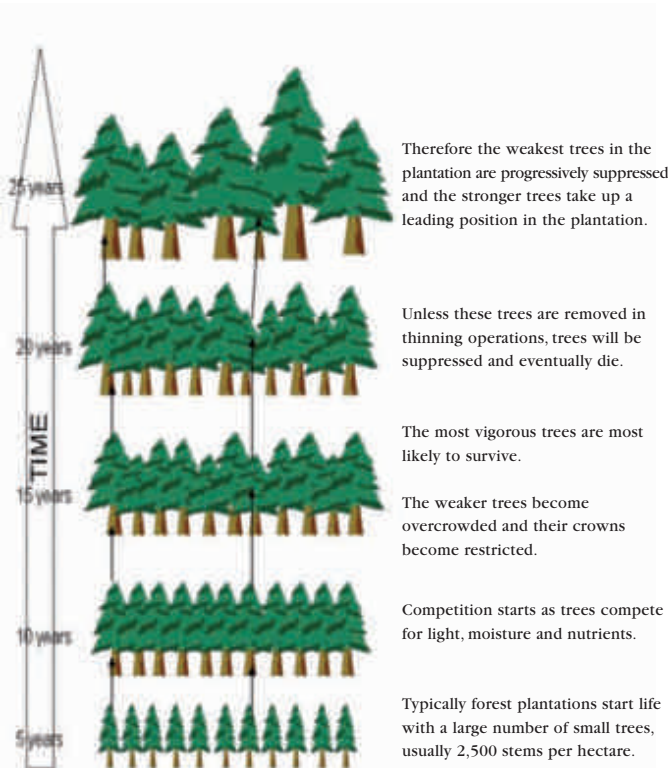
# THE PRACTICE OF THINNING FOREST CROPS

Niall Farrelly, Teagasc Forest Research, answers seven commonly asked questions about thinning forest crops.

## 1. HOW DO TREES GROW IN FORESTS?

Typically, a large number of trees are initially planted in forests, usually 2,500 stems per hectare. Competition and natural selection will reduce the number of trees over time, as the taller vigorous trees will overshadow the smaller weaker trees. The most vigorous trees are better at competing for light, moisture and nutrients and are most likely to survive. The weaker trees become overcrowded by their taller neighbours, their crowns become restricted and these trees eventually die (figure 1).

**Figure 1:** Growth and development of trees in a typical forest plantation.



## 2. WHAT IS THE DIFFERENCE BETWEEN THINNED AND UNTHINNED FORESTS?

Thinning removes surplus trees to concentrate timber production on a limited number of the best trees in the plantation resulting in increased diameter growth and producing more valuable larger diameter trees.

If forests are left unthinned, there is a high incidence of mortality in the forest i.e. trees will progressively die, leading to a reduction in total timber volume production. If these trees are removed by thinning operations, a proportion of the timber volume can be salvaged resulting in an increase in volume production over similar unthinned stands (figure 2).



**Unthinned stand, age 42 years, high mortality**



**Thinned stand, age 42 years, no mortality**

**Figure 2:** Forests that remain unthinned have a high degree of mortality, thinning salvages timber before it dies.

## 3. WHEN DO I CONSIDER THINNING?

Thinning needs to be considered once the trees are utilising all the available growing space. As a general rule of thumb, thinning of conifers should take place when trees are between 10 and 12 metres tall, provided that the forest is fully stocked. A more detailed assessment of thinning readiness can be assessed by measuring the diameter of the trees at breast height (1.3 metres above ground) in order to calculate the area taken up by each tree in a plot. These measurements calculate the basal area per hectare of the stand and are an indication of whether all the available growing space in the stand has been fully utilised. The Thinning Ready

Diameter at Breast Height (dbh) (cm)	Stems per hectare										
	2500	2400	2300	2200	2100	2000	1900	1800	1700	1600	1500
7	9.6	9.2	8.9	8.5	8.1	7.7	7.3	6.9	6.5	6.2	5.8
8	12.6	12.1	11.6	11.1	10.6	10.1	9.6	9.0	8.5	8.0	7.5
9	15.9	15.3	14.6	14.0	13.4	12.7	12.1	11.5	10.8	10.2	9.5
10	19.6	18.8	18.1	17.3	16.5	15.7	14.9	14.1	13.4	12.6	11.8
11	23.8	22.8	21.9	20.9	20.0	19.0	18.1	17.1	16.2	15.2	14.3
12	28.3	27.1	26.0	24.9	23.8	22.6	21.5	20.4	19.2	18.1	17.0
13	33.2	31.9	30.5	29.2	27.9	26.5	25.2	23.9	22.6	21.2	19.9
14	38.5	36.9	35.4	33.9	32.3	30.8	29.2	27.7	26.2	24.6	23.1
15	44.2	42.4	40.6	38.9	37.1	35.3	33.6	31.8	30.0	28.3	26.5
16	50.3	48.3	46.2	44.2	42.2	40.2	38.2	36.2	34.2	32.2	30.2
17	56.7	54.5	52.2	49.9	47.7	45.4	43.1	40.9	38.6	36.3	34.0
18	63.6	61.1	58.5	56.0	53.4	50.9	48.3	45.8	43.3	40.7	38.2
19	70.9	68.0	65.2	62.4	59.5	56.7	53.9	51.0	48.2	45.4	42.5
20	78.5	75.4	72.3	69.1	66.0	62.8	59.7	56.5	53.4	50.3	47.1
21	86.6	83.1	79.7	76.2	72.7	69.3	65.8	62.3	58.9	55.4	52.0
22	95.0	91.2	87.4	83.6	79.8	76.0	72.2	68.4	64.6	60.8	57.0
23	103.9	99.7	95.6	91.4	87.2	83.1	78.9	74.8	70.6	66.5	62.3
24	113.1	108.8	104.0	99.5	95.0	90.5	86.0	81.4	76.9	72.4	67.9
25	122.7	117.8	112.9	108.0	103.1	98.2	93.3	88.4	83.4	78.5	73.6
26	132.7	127.4	122.1	116.8	111.5	106.2	100.9	95.6	90.3	84.9	79.6
27	143.1	137.4	131.7	126.0	120.2	114.5	108.8	103.1	97.3	91.6	85.9
28	153.9	147.8	141.6	135.5	129.3	123.2	117.0	110.8	104.7	98.5	92.4
29	165.1	158.5	151.9	145.3	138.7	132.1	125.5	118.9	112.3	105.7	99.1
30	176.7	169.6	162.6	155.5	148.4	141.4	134.3	127.2	120.2	113.1	106.0

Figure 3: Thinning “Ready Reckoner” to decide when to thin a forest

The most commonly used thinning system involves systematically removing lines of trees to provide access for a harvesting machine and subsequent removal of selected trees between the lines

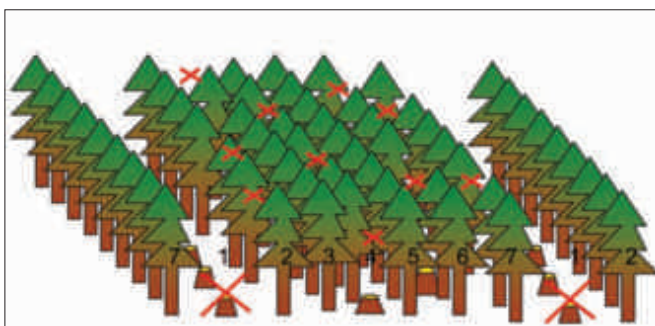
Reckoner produced by Teagasc uses growing stock (number of stems per hectare) as a guide to the assessment of thinning readiness (figure 3). The Thinning Ready Reckoner uses a combination of stems per hectare and mean dbh (diameter at breast height) to decide if a plantation is ready to be thinned. For example, a stand with 2,300 trees per hectare with an average dbh of 15 cm is given a green colour and is considered suitable for thinning. A combination that results in a light orange colour is considered not suitable for thinning.

This Thinning Ready Reckoner is available from the Teagasc Forestry website: [www.teagasc.ie/forestry](http://www.teagasc.ie/forestry).

#### 4. HOW DOES THE THINNING OPERATION TAKE PLACE?

The most commonly used thinning system involves systematically removing lines of trees to provide access for a harvesting machine

and subsequent removal of selected trees between the lines. This system has evolved over the years to accommodate the harvesting machinery used in Ireland (Figure 4). Thinning is carried out by removing lines of trees (for example 1 line in 7); this removes 14.5% of the crop. The remainder of the volume is achieved by removing all the lower canopy trees (i.e. suppressed and subdominant trees) between lines, while removing some competing co-dominant trees to reduce competition and a few of the rougher dominant trees. This helps to stimulate the growth of the remaining trees and leaves a fairly uniform crop.



#### Line thinning and selection

Figure 4: First thinning in Sitka spruce showing removal of line and selection of stems between lines.



Photo: First thinning in Sitka spruce showing removal of line and selection of inferior trees between lines leaving the larger trees to produce more valuable timber.



## 5. HOW OFTEN DO I THIN?

It depends on individual circumstances, the size of the plantation, the risk of windblow and timber prices. However, thinning tends to take place every 3 to 5 years.

For smaller plantations, thinning every 5 years probably makes more financial sense. For larger plantations or when there is a risk of windblow, a 3 year cycle could be considered.

This means that fewer trees are removed in each thinning, leaving fewer gaps in the canopy and reducing the risk of wind blow. The volume of wood removed in a 5 year cycle is much greater than the volume of wood removed in a 3 year cycle.

## 6. HOW MUCH VOLUME DO I REMOVE?

There is a limit to the volume of timber removed in thinning: forest crops should only be thinned to a level that will not affect timber quality or volume production. This is often referred to as Marginal Thinning Intensity (MTI).

Removing too many trees could reduce the ability of the stand to recover and start growing vigorously again after thinning, whereas removing the bigger trees reduces the long term timber production from the stand. Table 1 gives the maximum volume to be removed in any one operation from a Sitka spruce crop for 3 year and 5 year thinning cycles.

Depending on the growth rates of the trees, between 29 – 50 m<sup>3</sup>/ha of the volume can be removed for 3 year cycles, while between 49 – 84 m<sup>3</sup>/ha can be removed for 5 year cycles without affecting future volume production (Table 1).

HEIGHT (M)	AGE (YEARS)	YIELD CLASS (m <sup>3</sup> /ha/yr)	3 YEAR CYCLE (m <sup>3</sup> /ha)	5 YEAR CYCLE (m <sup>3</sup> /ha)
12.1	18	24	50	84
12	19	22	46	77
11.7	20	20	42	70
11.3	21	18	38	63
10.6	22	16	34	56
10.2	23	14	29	49

**Table 1: Approximate height and age of first thinning in Sitka spruce for a range of yield classes with the volume per hectare to be removed in thinning based on a 3 and 5 year cycles (After Edwards and Christie 1981)**

## 7. WILL THINNING INCREASE THE PROFITABILITY OF MY FOREST?

The short answer is yes. It is important to maximise the revenue potential of the crop with a long term investment such as forestry. Thinning will increase the value of the crop, as the average tree size is increased and there is a larger proportion of valuable sawlog produced over the rotation than in unthinned plantations. In addition, the value of the crop is released at periodic intervals over the crop rotation in thinning operations, giving periodic income generation, compared with all the value of the crop being realised at a later stage in the no thinning scenario.

Financial analysis carried out by Teagasc indicates that thinned crops are more profitable with yield increases of up to 12% more than unthinned crops. In general, thinned crops are more productive and have a higher proportion of more valuable large timber (i.e. sawlog) at clearfell stage than unthinned stands.

Other factors such as the increase in wind risk associated with thinning will play a key role in the overall decision of whether to thin or not. Markets, location, road access and the availability of machinery may affect the profitability of thinning. Where possible, growers should consider thinning their plantations.

## FURTHER READING

Edwards, P.N. and Christie, J.M. 1981. Yield Models for Forest Management, Forestry Commission Booklet 48, HMSO, London.

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