CURRENT SCANDINAVIAN THINKING ON THINNING PRACTICE AND YIELD

CHARLES CARBONNIER
Royal College of Forestry, Stockholm, Sweden

INTRODUCTION

Since Scandinavia is situated far away from here I would like to start with some information on this territory.

The Scandinavian or the Nordic countries consist of Denmark, Finland, Norway and Sweden. Iceland also belongs to the group but is of minor interest in the forestry sense. Scandinavia is situated in the northern part of Europe between latitude 55 and 70 degrees.

In Table 1 you will find some statistics from this area. I would like to point to only a few figures. There are about 22 million people living in the Nordic countries. The forest area amounts to 49 M ha from which Finland, Norway and Sweden account for 99%.

The growing stock is running from 73 m^3/ha in Norway to 100 in Denmark. With the exception of Denmark, Scots pine and Norway spruce are predominant.

The annual increment is estimated at about 150 M m^3.

In the beginning of the 1970s the annual cut was about 140 M m^3.

TABLE 1—Forestry statistics of the Nordic countries

		Denmark	Finland	Norway	Sweden	The Nordic Countries
Number of inhabitants, million		5.00	4.65	3.90	8.13	21.68
Forest land	M ha	0.5	18.9	6.5	23.5	49.4
Agricultural land	M ha	3.0	3.2	1.0	5.0	12.2
Other land	M ha	0.8	8.5	23.4	12.5	45.2
Growing stock						
Volume o.b.	M m^3	47	1453	479	2290	4269
Stocking	m^3/ha	100	76	73	97	
Growing stock by species (percent)						
Scots pine		53	44	31	38	
Norway spruce			39	52	48	
Broad-leaved trees		47	17	17	14	
Annual increment (o.b.)						
	M m^3	2.4	56.9	16.6	72.7	148.6
	m^3/ha	5.5	3.0	2.5	3.1	
Annual cut (o.b.)	Year	1972	1973	1972/73	1970/72	
	M m^3	2.1	55.4	10.3	69.3	137.1

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As can be seen, annual cut and increment are balancing in Finland and Sweden while there seems to be some undercutting in Norway.

According to Table 2 the forest industry production of the Nordic countries in 1973 amounted to 25 M m³ sawnwood and 18 million tons of pulp. In addition 1.2 million tons of fibreboard and 2.5 M m³ of particle board were produced. These quantities constitute 5% of the world production of sawnwood and 15% of pulp. The corresponding figures for fibreboard and particle board are 11% and 7%.

TABLE 2—Forest industries production in the Nordic countries 1973

	Sawnwood M m³	Pulp M tonnes	Fibreboard M tonnes	Particle board M m³
Denmark	0.8	0.1	—	0.4
Finland	8.1	6.7	0.3	0.9
Norway	2.1	2.2	0.2	0.4
Sweden	14.1	9.4	0.7	0.8
The Nordic countries	25.1	18.4	1.2	2.5

DISCUSSION

Stand Development and Rotation

What I am going to say mainly refers to Swedish conditions, but I think it will be representative also for Scandinavia on the whole, possibly with the exception of Denmark.

Before speaking about thinning I think I should exemplify stand development by making use of some yield tables for Scots pine and Norway spruce. The growth process in pine stands is illustrated by Fig. 1, which gives mean annual increment under bark of merchantable timber by different sites and over stand age. The yield tables used here are starting with 2000 trees per hectare before the first thinning, except for T28 which starts with 3000 trees. The site index (T28, T24, T20 and so on) means that the top height of the stand at 100 years is 28, 24, 20 m respectively.

According to Fig. 1 the mean annual increment culminates at a stand age of about 100 years on sites T28 and T24, at 110 years on T20 and at a still higher age on T16. These growth periods correspond pretty well with the rotations used in practice in pine stands.

The growth of spruce stands was recently subjected to thorough studies (Eriksson, 1974). I think I should report on some results of this work. Figure 2 thus indicates the relationship between mean annual increment and stand age. In this case the increment is expressed in m³ of stem wood over bark. In these tables the number of stems before the first thinning runs from 1800 on the poorest site to 2500 stems/ha on the best sites. The thinning programmes also were differentiated with regard to site. Thus, the number of thinnings increased from one single thinning on G16 to four on G28 and G32. As can be seen from Fig. 2 the mean annual increment in no case culminated within the age interval which is covered by the tables.

However for several reasons it is often not possible to postpone the final cut

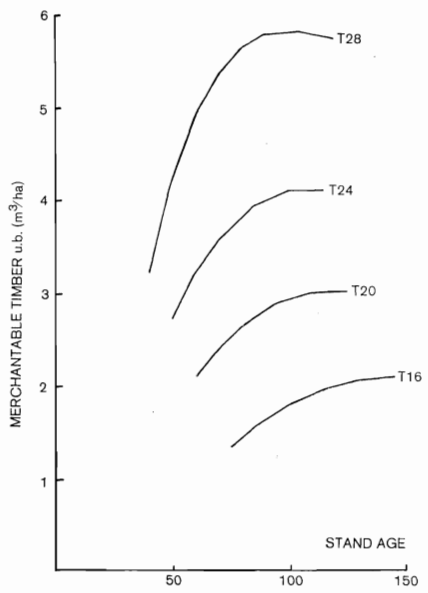

FIG. 1—Scots pine (Andersson, 1963)

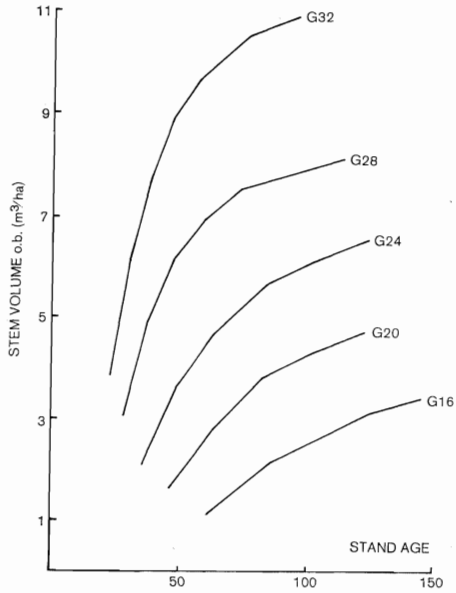

FIG. 2—Norway spruce (Eriksson, 1974)

(Relationship between mean annual increment and stand age)

until the time of culmination of the mean annual increment. Thus, the frequency of root rot and the risk of windthrow increases with stand age. Economically too a very long rotation might be unprofitable. I would say that in practice 70-80 year is a normal length rotation for spruce stands on good sites in southern Scandinavia.

Extent of Thinnings in Practice

Considering the long rotation in Scandinavian forestry and developments in forestry research it is obvious that thinning practice should change during the course of time. Fig. 3 shows the breakdown of gross felling by cutting methods during the period 1957-73. The source is the stump inventory of the Swedish National Forest Survey.

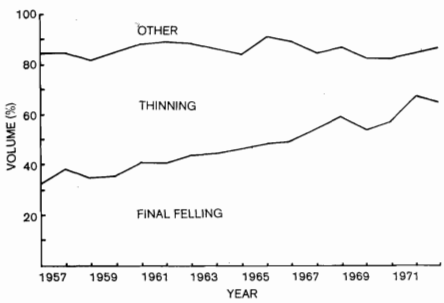

FIG. 3—Gross felling volume by felling methods (1973 års skogsutredning)

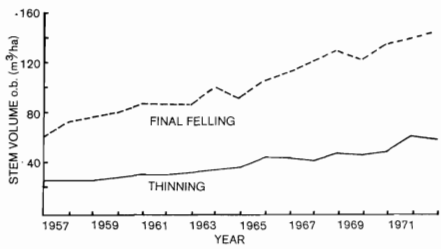

FIG. 4—Gross felling volume per hectare in final felling and thinning (1973 års skogsutredning)

It is evident that the share of thinning has diminished in favour of final cut. In the felling season 1962-3 the thinning and final cut volumes were equivalent. Ten years later the thinning volume was only about 20 percent of the total felling.

This development should be seen also in the light of changed conditions for forestry. In the 1920s and 1930s the supply of labour was abundant. The forests were in a period of reconstruction and consequently there were plenty of young stands. For natural reasons thinning became the predominant felling method. This situation remained until the early fifties. During this long period final fellings were neglected. The age class distribution had become unbalanced with a serious deficit of stands in the age under 40 years. At that time most forest owners then realised the necessity of increasing regeneration fellings. This development increased further in the 1960s. When conditions for forestry became severe and stumpage values were very low, the financial strain speeded up the mechanisation of logging operations in Scandinavia as all over the world. However, full mechanisation was easier to accomplish by final felling than by thinning. Therefore, as can be seen from Fig. 3, the thinning portion decreased still more.

During this period the forest industries expanded considerably. In the future the capacity of the industries will be sufficient for using all timber that can be produced under proper forest management in Scandinavia. Proper management means, among other things, that a certain amount of the wood production should be harvested in the form of thinnings. Forestry without thinnings means that a quantity in the region of 20 percent of the total production will be wasted by natural mortality. To that should be added the benefits of thinnings on the residual stand.

Thinning Programmes

For the time being most forest owners are intending to thin their forests to an adequate extent. However, there is always the balancing between light thinnings at short intervals to provide optimum stand development and heavy thinnings at long intervals in order to cut down the logging costs. It is difficult to state what could be considered as the normal thinning programme in Scandinavian forests. Yet, I would like to mention the thinning schedules published by the Swedish National Board of Forestry.

The National Board of Forestry is responsible for the silviculture on private forests and therefore the thinning schedules might be representative of the bulk of the Swedish forests.

The schedules are based on basal area and top height. They foresee 1 to 3 low thinnings, depending on site, during the rotation. It is recommended that at least 50 m^3/ha should be cut at each thinning. If the schedules were applied in forestry throughout Sweden I think it would mean that thinnings would average 30-40 percent of the annual felling.

The trend towards heavier thinnings is illustrated by Fig. 4. The lower trace represents the average output from thinnings in Sweden. The thinning removal thus increased from about 30 m^3/ha in the late 1950s to 60 m^3/ha in the early 1970s.

Thinning Systems

Lately analyses of conceivable logging systems for future thinnings were carried out at the Royal College of Forestry (Bredberg, 1974). The analysis presented attempts

to evaluate and compare different mechanised thinning systems. One of the most important results was that the high costs for harvesting small trees can be considerably reduced by designing the machines for the handling and processing of tree bundles rather than single trees. However, it must be concluded that there are no machines yet available that can extract trees from the stand without damaging the remaining trees, and at the same time process the trees cheaply enough.

In the last few years considerable interest was paid to various winching systems. However, such systems demand a considerable amount of manual work and are consequently sensitive to increasing labour costs.

In practice probably more than 90% of the thinnings are performed by the short wood system, with motor-manual cutting and dragging to strip roads at 15-25 m distance and off-road extraction by forwarder. For the remaining 10% of the thinnings, winching systems are used.

So far mechanised thinning systems are not in practical use. Intensified development of such systems and machines that make thinnings possible at reasonable costs and give adequate consideration to biological and ecological factors should be a most important task.

REFERENCES

ANDERSSON, S. O. 1963: Yield Tables for Plantations of Scots Pine in Northern Sweden. — Medd från statens skogsforskningsinst, Bd 51: 3.

BREDBERG, C. J. 1974: Some Mechanised Thinning System, — Thinning in the forestry of the future. **Department of Operational Efficiency (Stockholm), Res. Notes Nr 69.**

ERIKSSON, H. 1974: Granens produktion i Sverige. — Framtidsskogen — Skogsproduktionens mål och medel. **Department of Forest Yield Research (Stockholm), Res. Notes Nr 33.**

1973 ARS SKOGSUTREDNING: Virkesbehov och virkestillgång: Ds Jo 1975: 1.