

Swedish Forestry

A Question of Balance

E. P. FARRELL

Department of Agricultural Chemistry and Soil Science,
Faculty of Agriculture, University College,
Belfield, Dublin 4

ABSTRACT

Growing stock in the Swedish forests has increased greatly over the past fifty years. However, a large increase in industrial productive capacity in recent years has given rise to concern over a possible wood shortage. Two government commissions have been appointed to consider forest policy. The first produced radical proposals to promote the utilisation of existing forests. These proposals, which involved a departure from the principal of sustained yield were rejected by the government. The second commission made three alternative proposals. After considerable debate the government adopted a policy of aiming to achieve a high level of productivity, while giving close consideration to environmental aspects and the public interest. The question which must now face the forest manager is whether it is possible to achieve a high level of forest production while accepting the environmental restrictions imposed upon him.

INTRODUCTION

Although Sweden has less than 1% of the world's forest area, she occupies a prominent and important position as a producer of forest products. In 1976, Sweden was the world's fifth largest producer of both saw-timber and pulp and the seventh largest manufacturer of paper. Sweden is an old forestry nation, long possessed of stable government and a strong forestry tradition. Skogshögskolan, The Royal College of Forestry, until recently located in Stockholm, celebrated its 150th anniversary in 1978. Despite this, Sweden has seen great changes, both economically (Sweden was one of the poorest countries in Europe 100 years ago) and in the forestry

sector. There has been a large increase in standing volume over the past 50 years. Annual increment increased from 50 million m³ in the 1920s to 80 million m³ at the beginning of the 1960s. Production in the forest industry has increased more rapidly. Saw-timber production was 7.2 million m³ in 1953. In 1974, it was about 14 million m³. During the same period, pulp production increased from 3.2 million tonnes to 9.8 million tonnes. The forest industry's annual use of raw material has increased from 30 million m³ to 62 million m³ (underbark volumes) over 25 years. Industrial capacity continued to increase until fears of a wood shortage led the government to invoke an act restricting expansion within the forest industry. By 1970, annual increment had fallen to 75 million m³. Trade in roundwood and chips, in which up to 1974 Sweden had had an export surplus, has since shown a reversal and in 1975 and 1976, Sweden was a net importer of these categories of forest produce.

It is the purpose of this paper to look at the new forest policy which has emerged from the conflicting interests of a giant forest industry, which has expanded beyond the level where it can be satisfied with safety from native timber resources, and a vocal, educated public claiming the forest, "naturen" (lit. The Nature), as a part of their heritage and acutely aware of the hazards of intensive management to the environment.

DISTRIBUTION FEATURES

The 23.5 million ha of productive forest land represents 57% of the country's total land area. The state owns 19% of this forest land, the Swedish Church and municipal authorities own 6%, 25% is in the hands of forest companies and the remaining 50% is privately owned. The state forests are concentrated in the north, where the climate is less favourable, stocking density is lower and the soils are poorer. Whereas mean annual increment is calculated at 3.2m³ per ha per annum for the country as a whole, the figure for the state forests is 2.0, 3.9 for the company forests, which are located mostly in central Sweden and 4.8 for the privately owned forests, which are situated mainly in the south. There are about 240,000 private owners, 54% of them with forest of less than 25ha. The private forests are responsible for more than 60% of total wood production. Species distribution is 38% pine (*Pinus sylvestris* L.), 48% spruce (*Picea abies* L.) and 14% broadleaved species, mostly birch (*Betula* spp.).

DEVELOPMENTS SINCE 1920

When Sweden's forest inventory was initiated in the 1920s, standing volume was registered at 1800 million m³. At this time, the

growing stock was recovering from a period of exploitation forestry. The expansion of the mining industry and the direct participation of the mining companies in forestry had resulted in an intensive exploitation of the country's forests. A system of selection fellings had been practised, regulated only by so-called "dimension laws", which prescribed only that the trees selected for felling must be over specified dimensions. This practice, which was most prevalent in the north, led inevitably to a decrease in growing stock and a deterioration in stand quality. The situation was remedied by the 1903 Forestry Act which put on forest owners the obligation to replant after felling. Growing-stock increased, although as a result of the selective felling systems adopted to encourage natural regeneration in the 1920s and 1930s, large areas of poorly stocked, slow-growing forest remain, particularly in the north. Consequently, age-class distribution is uneven, with a surplus of overmature forest and deficiencies in the younger age-classes.

Growing-stock has continued to increase up to the present as shown in Fig. 1. Annual increment, which peaked at over 80 million m^3 in the early 1960s, has since declined to about 75 million m^3 . One

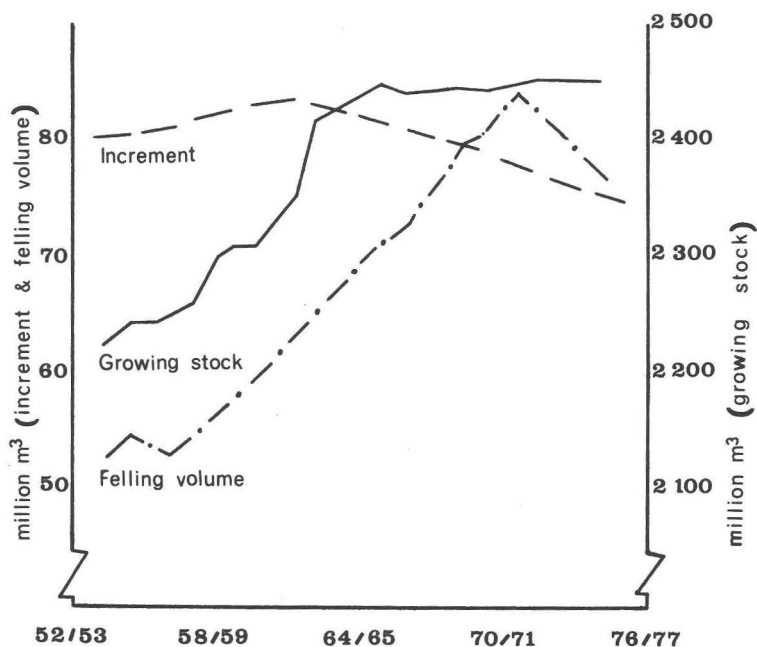


Fig. 1 Increment, growing stock and felling volume of Swedish forests 1952-1976. (From Skog för framtid, SOU 1978:6).

of the main reasons for this decline has been a concentration of final fellings in stands of relatively high current annual increment. Felling volumes have increased greatly over the past 25 years. In the middle of the 1950s, the volume felled annually was about 50 million m^3 ; today it is about 75 million m^3 , thus equalling annual increment. During the same period, there has been a large increase in the proportion of total fellings which have come from final felling as can be judged from the fall in the area thinned annually (Figs. 2 and 3). While it is difficult to separate cause and effect in this connection, it is interesting to note that during this period, which has seen the rapid development of mechanisation, employment in forestry has fallen to less than half of what it was in the mid-1950s and productivity, measured in terms of days work for all forest operations per m^3 timber felled, has increased from 1.1 days per m^3 in 1950 to 0.13 days in 1975.

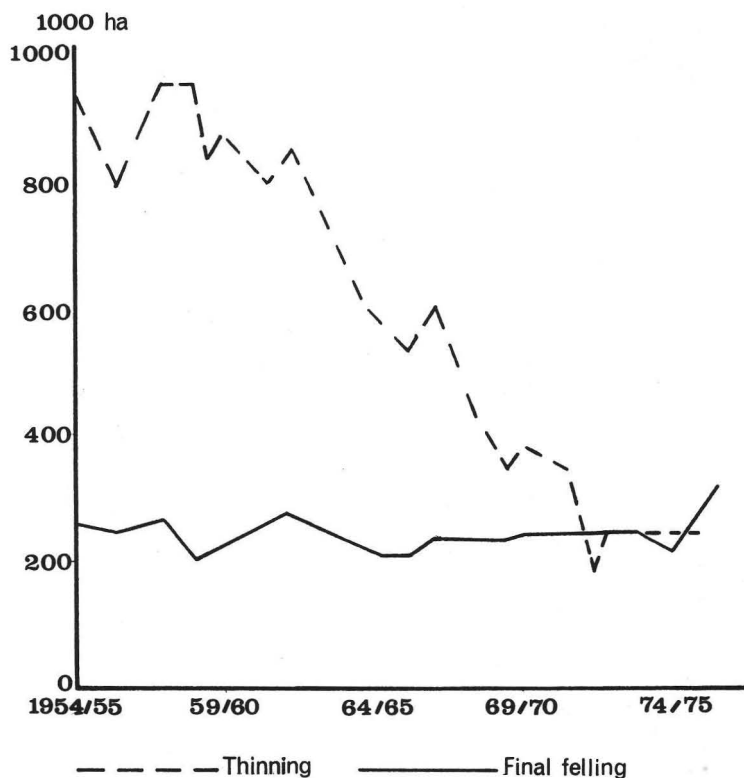


Fig. 2 Area of thinnings and final fellings in Swedish forests 1954-1976. (From Svensk skog, Skogsstyrelsen, 1977).

During the late 1960s and early 1970s the Swedish forest industry expanded greatly. During the early 1970s, overproduction by the world pulp and paper industry depressed prices. However, a sharp increase in demand in 1973 and 1974 resulted in large price increases. The recession led immediately to a fall in demand in 1975 and the government subsidised stockpiling by the forest industry. The fluctuating price of forest products on the world market since the 1940s and the consequent low level of the forest owner's net conversion value per m^3 , calculated at fixed monetary values, have made forestry an unattractive investment for most of this period. The position was particularly bad during the late 1960s and early 1970s and has improved only in the past six years.



Fig. 3 Thinning operation in a mixed conifer forest in central Sweden.

(Photo: Jöran Fries).

SILVICULTURAL TRENDS

Some of the less desirable trends, from a silvicultural viewpoint, in Swedish forestry, can be attributed to the low level of return obtainable. Among these may be included the very low level of establishment achieved following regeneration. According to the National Board of Forestry, who conduct annual studies of growth development, regeneration is inadequate on more than 60% of felled areas. Beating up is, however, practiced. Consistently poor results have been obtained with natural regeneration, partly because an inadequate number of seed trees have been left. When the use of DDT was banned in Sweden some years ago, forestry received a dispensation and the practice of dipping plants before planting-out, as a protection against pine weevil (*Hylobius abietis* L.) was continued until 1975, when it was forbidden in forestry also. No effective replacement is available. To a certain extent, foresters have fallen back on the old practice of leaving clear-felled areas fallow to allow weevil numbers to pass their peak. Thus, in 1975, plants worth some 5,000,000 Swedish Crowns (£580,000) were left unused in nurseries and went to waste. The ban on DDT has led to a considerable increase in soil scarification as a preplanting treatment. Plants not treated with DDT are better protected against insect attack when the soil around the plant is laid bare. While advocates of DDT claim that its total national use within forestry was small (about 10 tonnes in 1974) and that, in view of its widespread dispersion and low levels of application per ha, its use should not be judged on the same basis as in agriculture, bodies devoted to the protection of the environment maintain that the ban should not be revoked. The problems facing present-day forestry are, they say, of foresters own making, the result of the introduction of intensive silvicultural techniques without adequate consideration of the ecological consequences.

FUTURE FOREST POLICY

Future Swedish forest policy has been the subject of two recent government commissions. The big question facing these commissions has been the role that forestry should play in society and in the national economy in the future. The first commission (SOU 1973) sought to radically alter the direction of Swedish forest policy. The commission held that traditional forest policy aimed to create and maintain resources, rather than to stimulate utilisation. The new policy should promote the utilisation of existing forests. This change in policy was inspired by two fundamental characteristics of forestry in Sweden at that time (the beginning of this decade). The first was the diminishing importance of the forestry sector in the national economy. In the early 1950s,

production in the forest industry accounted for 45% of the country's exports. By 1973-75, the figure was 23%. Forest workers made up only 1.3% of the total workforce and forest industry employees 2%. This development, which took place against the background of a rapidly *expanding* forest industry, was due to structural changes within Swedish industry, with increasing emphasis on production within the engineering and chemical industries. Consequently, the commission argued, the principal of sustained yield, which had guaranteed a continuing supply of material and source of employment in the past, could be dispensed with. Forestry was no longer needed to provide employment for a high proportion of the workforce. The goal now should be to stimulate the forest industry, encouraging the rapid utilisation of the surplus reserves of native timber. The commission proposed an expansion of cuttings to a level of about 90-95 million m³ per annum and possible to 100 million m³ within 10-15 years. This latter figure was some 25 million m³ greater than the annual increment at the time of the commission's discussions. Obviously, this level of cutting could not be maintained indefinitely. The period covered by the plan was 15 years.

The commission's report was rejected by the government and another commission established (SOU 1978). This commission advocated adherence to the principal of sustained yield. They used a long-term simulation model based on data from the National Forest Survey to analyse and describe the balance between potential utilisation and annual increment and the long-term consequences of following a series of fundamental policy decisions. They put forward three alternative policies for consideration. The first was that present policy should remain virtually unchanged. Thus, gross fellings should amount to about 75 million m³ per year over a 100 year period, and, in consequence, the present forest industrial plant should work to about 85% of its capacity.

The second alternative, advocated by the commission itself, anticipated a significantly higher level of output, increasing to 80 million m³ per year in the 1980s and to 89 million m³ per year in 100 years. During the 1980s, the forest industry could expect to operate at 90% capacity. This alternative entailed a large increase in fertilisation and drainage operations and interestingly in increased use of *Pinus contorta* Dougl. in order to increase annual increment and to bridge the potential gap caused by the uneven age-class distribution.

Sweden, like Ireland, has a poor native flora and a considerable number of exotic species have been grown experimentally. Species which have been tested include, besides *Pinus contorta*, *Larix russica* (Endl.), *Picea mariana* Mill., *Abies lasiocarpa* (Hook.) Nutt., *Pseudotsuga menziesii* (Mirb.) Franco and *Picea sitchensis*

(Bong.) Carr. The latter has been grown, very successfully in small experimental stands at Tönnersjöhedens Research Forest in Halland, near the west coast. The climate here is not unlike our own, although annual precipitation, at just over 1000mm would seem borderline for Sitka spruce. Nevertheless, rapid growth rates have been recorded. By far the most successful exotic in Sweden is *Pinus contorta*, today the centre of a great deal of discussion and some controversy. *Pinus contorta* has been used in Sweden for the past 50 years, but early plantations were poorly distributed and lacked adequate provenance documentation or comparison. Interest in the species has increased over the past 10-15 years, due largely to the efforts of some of the larger companies, who saw the value of increasing the proportion of the raw material supplied to their mills, from their own forests. In 1975-77, between 40 and 45 million plants were produced each year, representing some 10% of all plants produced and corresponding to a planted area of perhaps 20,000ha per annum. Growth of interest in the species results from forecasts, on the basis of ongoing research, that volume increment will be 20-25% greater than in the native Scots pine. This is based on overbark measurement and when allowance is made for the thicker Scots pine bark, the productivity advantage increases to 30-60%. Even when compared with *planted* native pine an increase in wood production of 10-25% is anticipated and in addition, optimum rotation should be 15-20 years shorter. The species has proved most successful in the northern part of the country and shows comparatively, to the best advantage on the poorer mineral soils. Hardiness and survival capacity are the principal factors in provenance selection. In the far north, seed from Yukon sources has proved most successful, while in central Sweden, locations in British Columbia have given the best results. The commission laid great emphasis on the use of *Pinus contorta* in their second alternative programme. This called for a planting programme of 28,000ha per annum. According to this, 6% of forest land would be under this species in 50 years, with a projected increased output of 2 million m³ per year (overbark). The concentration of *Pinus contorta* in central and northern Sweden, would mean that at the end of a 100 year period, the species would cover 14% of the total forest area of these regions. This is the cause of widespread concern among critics of this alternative, who feel the risk of ecological catastrophe, in the form of insect or disease attack, is too great. Concern has also been expressed about the stability of the species.

The attitude expressed towards the general use of *Pinus contorta* is typical of the concern of a considerable body of opinion about the pace and direction of current developments. The commission's second alternative would increase the area fertilised from 150,000ha to about 300,000ha per annum in the 1980s and to

450,000 in the 1990s, this level to be maintained thereafter. In Sweden, nitrogen fertilisers are by far the most important, deficiency of this element being widespread. Fertilisers are normally applied by air to pole-stage crops, with reapplications at 6-8 year intervals. Growth increments of up to 40% may be expected from fertilisation. Ammonium nitrate is now the preferred source of nitrogen, as it has been clearly established to be superior to urea. Unfortunately, with ammonium nitrate, the effects on water quality can be quite serious. Rapid increases in the nitrate content of the groundwater may occur following applications of ammonium nitrate and, for a short time, safety levels for drinking water may be exceeded. This problem and possible influences of nitrogen fertilisers on the soil microflora and the leaching of nutrients also give rise to concern.

The commission's third alternative was to follow a policy of ecologically inspired restrictions. Chemical control techniques would be severely restricted, the use of fertilisers reduced and limitations put on drainage operations. In consequence, fellings must be reduced to less than 70 million m³ per year and, due to reduced use of herbicides, the proportion of hardwoods, principally birch, in the growing stock would increase markedly.

Despite prolific regeneration of birch, most experts believe that conifers must continue to be the basic raw material of the Swedish forest industry. Conifers have higher volume production and although large dimension birch fetches a high price from the sawmills, most of the birch in Swedish forests will never make better than pulpwood-dimensions. The short-fibre pulp which birch yields is of inferior quality and so the price paid for pulpwood is low. Indeed, sometimes it is impossible to find a market for it. While there is little scientific evidence to back it up, many would maintain, however, that a small proportion, perhaps up to 10% of birch in a young stand has a beneficial effect on organic matter decomposition and nutrient cycling. Thus, total elimination of birch, which would be extremely difficult in view of the long distance the seed is carried, is rarely the desired objective. Aerial application of herbicides and mechanical cleaning are the standard means of hardwood control. While the former is a much cheaper if less selective technique, it has been the subject of heated controversy throughout the 1970s. In recent times it has become an important political issue, with members of protest groups occupying areas due for spraying, thereby preventing or impeding operations. Shortly before last year's elections, the State Forest Service suspended spraying operations for the remainder of the season, leaving some 10% of its programme uncompleted.

The campaign against spraying of chemicals in forestry is closely linked to the role of the forest in Swedish society and the traditional

rights of every citizen to use the forest for recreation, camping and picking berries. These long established rights are jealously guarded and interventions, such as spraying or fertilisation, are seen as unwarranted interference and as a threat to the maintenance of these rights. Thus, the spraying of herbicide is viewed as an immediate interference with the right to pick berries and as a long-term ecological threat.

THE GOVERNMENT'S DECISION

The forest industrial sector, lacking centralised control, overreacted to economic developments in the mid-1970s and now has excess capacity. Should forest production be increased to satisfy, as far as possible this demand or should all risk of ecological damage be avoided and society be given the controlling interest in the utilisation of its forests and the protection of its rights? In other countries, such as Finland, where the forestry sector is dominant in the national economy, such a question would be answered rather easily, but in Sweden, prosperity presents the luxury of choice and the dilemma of decision.

The government's response to the commission's proposals and the controversy they generated was to try to find a middle ground. Thus the new forestry act, passed by parliament in May 1979, states that the forests will be managed with the objective of providing a high and sustained yield while taking every precaution to protect the ecosystem and to safeguard the public interest. The government has clearly stated that industry's existing productive capacity cannot be allowed to control the level of forest production in the long term. In its concern for the environment, the government has rejected the more radical proposals of the commission. Care is called for in the use of exotic species. Taking into account the risk of insect and fungal attack and the relatively poor quality of its saw-timber, further research is needed before greater use of *Pinus contorta* can be recommended. Accordingly, the National Board of Forestry is to be given powers to restrict the use of exotic species. The use of DDT is not to be reintroduced, the use of chemicals in general is to be limited where possible, forest fertilisation is not to receive any further government promotion and drainage of peatland areas is to be controlled pending the completion of a Nature Conservancy inventory of the country's wetland resources.

CONCLUSIONS

Sweden has come through a period of intensive discussion and detailed consideration of her forest policy. In the early years of the decade, the first government commission saw a necessity to

stimulate the forestry sector in order to meet the demands of industry. They produced a radical, if unacceptable proposal. The tone of the second commission was much more conservative. But of the three alternative proposals put forward, they advocated acceptance of the most radical in order to stimulate a significant increase in productivity. However, in the course of the debate that followed, the original objective, to reach a consensus on how to achieve a balance, within the sustained yield concept, between production and utilisation, was lost sight of. Debate centred around ecological issues and the influence of silvicultural measures on the environment. The end result may seem less than satisfactory to many. The government position has been clearly stated, the forest industry will not control forest policy. Nevertheless, while it is the intention to promote and sustain a high level of productivity, the environmental constraints on the forest manager are severe.

In the past it has been possible to increase production i.e. felling volume, without long-term risk because it never exceeded annual increment. Now with annual increment declining steadily over the past twenty years and at present equal to felling volume (Fig. 1), the task of increasing the latter presents a greater challenge. Progress has been made in recent years which has allowed the utilisation of material of smaller dimensions than previously. Plant geared to the processing of birch and other hardwoods has been expanded. The results of PHU (Project Whole Tree Utilisation) published three years ago, show that in harvesting the 62 million m³ (underbark) utilised annually, 50 million m³ is left in the forest. It is estimated that of this, 7.7 million m³ could be utilised in the pulp industries and a further 7 million m³ as fuel. However, there is still a great deal of uncertainty surrounding the economics and the practicality of this scheme. Whole tree utilisation was not considered by the commission, nor by the government in its proposals. It must be assumed therefore that at least a part of any increase in felling volume must be accounted for through increases in growth increment.

One wonders if it is possible for the forest manager to increase growth increment while accepting new restrictions on the techniques to which he has become accustomed and which have served him well in the past.

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