Effects of afforestation on wood production and forest yield

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Introduction

From the first plantings and experiences in the afforestation areas in West and North Norway it became evident that there was a large potential for increasing the yield by changing tree species, especially from mismanaged broadleaves and pine to dense spruce plantations. The focal point in this chapter will therefore be the experience in Norway, with some examples from other countries.

Most Norwegian studies concerning the effects of changing tree species in reforestation areas have been conducted in neighbouring stands that offer similar growth conditions. The results from these studies (Table 2) contrast the results from mixed stands in South-East Norway and Sweden, where the growth differences between the tree species is less pronounced. About 85% of the reforestation areas in West and North Norway consist of Norway spruce plantations (approximately 250,000 ha), Sitka spruce (approximately 45,000 ha), and other conifers, including Scots pine, Douglas fir, larches and others.

Growing stock in the afforestation areas has more than doubled since the 1930s and the annual increment is about three times higher. Presently, the 320,000 ha of natural Scots pine forests in West Norway have an annual production of about 2.5 m³/ha whereas the 165,000 ha of spruce plantations have an annual yield of about 7.9 m³/ha.

In the afforestation plans of the Forestry Commission the predicted yield of the spruce plantations was 5 m³/ha/yr. With a spruce plantation area of 275,000 ha, this would imply a future potential annual yield of about 1.38

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Gain in site index (H40 in m)</th>
<th>Gain in yield (m³/ha/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downy birch → Norway spruce</td>
<td>7–9</td>
<td>6–8</td>
</tr>
<tr>
<td>Scots pine → Norway spruce</td>
<td>6–8</td>
<td>4–6</td>
</tr>
<tr>
<td>Norway spruce → Sitka spruce</td>
<td>3–4</td>
<td>3–4</td>
</tr>
<tr>
<td>Downy birch → Scots pine</td>
<td>0</td>
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<tr>
<td>Downy birch → Sitka spruce</td>
<td>8–10</td>
<td>7–9</td>
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<tr>
<td>Scots pine → Sitka spruce</td>
<td>6–8</td>
<td>6–7</td>
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<tr>
<td>Scots pine → Japanese larch</td>
<td>6–8</td>
<td>4–6</td>
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<tr>
<td>Downy birch → European larch</td>
<td>6–8</td>
<td>4–6</td>
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<tr>
<td>Grey alder → Norway spruce</td>
<td>7–9</td>
<td>6–8</td>
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</table>
Afforestation in the Nordic countries

Figure 7. Scots pine logs in eastern Norway. This species is one of the most economically important tree species in Scandinavia. Photo: Jon Geir Petursson.

million m$^3$. However, in the yield tables for Norway spruce in West Norway the production has varied from 6.1 to 14.7 m$^3$/ha/yr, therefore 5 m$^3$/ha/yr must be a minimum estimate. In new yield tables from Skogforsk the production in unthinned Norway spruce plantations has varied from about 6 to 15 m$^3$/ha/yr, these increments being attained in 100 to 60 years, respectively. In Sitka spruce the yield has varied from 12.0 to 32.0 m$^3$/ha/yr. The latest increment figures for Norway spruce plantations from the 1990s show 1.7 million m$^3$. By applying yield figures of 8.5 m$^3$/ha/yr in West Norway and 4.5 m$^3$/ha/yr in North Norway the spruce plantations will yield a total of about 2.2 million m$^3$ per annum. It has been estimated that the yield from spruce plantations in West Norway would reach a potential harvesting level of about 0.8 million m$^3$ in 2020 and 2.7 million m$^3$ in 2060, although these predictions are highly dependent on the investment programs. Therefore, with a further stabilization of the spruce area, it seems likely that the spruce plantations in the afforestation areas will yield slightly more than 2.0 million m$^3$.

The present annual harvested volumes are about 0.15 million m$^3$ in northern Norway and 0.25 million m$^3$ in western Norway, i.e. the potential for gradually increasing the cutting is substantial. The natural pine and broadleaves are having less economic importance in Norwegian forestry because 80-90% of the present commercial harvesting is taking place in the productive spruce plantations.

Benefits of afforestation

Worldwide, economic development theory provides a basic rationale for tree planting for both industrial and non-industrial purposes. In Norway the afforestation rationales can generally be confined to several factors, such as
increase of forested land and larger growing stock, environmental or social benefits, stimulation of local economy and multiplier effects.

**Increase of forested land and larger growing stock**

More wood resources offer more possibilities and flexibility for wood-using industries; adding industrial value in the forestry sector, and will also strengthen the farmers’ possibilities for higher income and maintaining a rural way of life.

Afforestation and forest resources influence the real estate market. A property with great wood resources is far more valuable than properties without any woods.

The national economic rationale may also be confined to import substitution, less dependency on imports or generation of greater export income.

**Environmental/social benefits**

There are several environmental and social benefits to be gained by afforestation, i.e. storage of carbon, soil and water protection, snow and slope stabilization, windbreaks, less pressure on natural forests and promotion of outdoor activities and public health.

**Stimulation of the local economy**

Subsidizing tree planting in larger reforestation programs will increase government income from taxes and stimulate the demand for labour, for instance through forest nurseries, transportation, services and management.

Figure 8. Wood products are more than just paper and timber. Scandinavians have long tradition of local use of wood. This traditional fench in northern Sweden is a good example for alternative use. Photo: Jon Geir Petursson.
**Multiplier effects**

Afforestation will offer “multiplier effects” by stimulation of labour in other sectors: services, road construction, trade, etc. Norwegian studies from the 1970s revealed that one worker in the forestry sector provided occupation for 1.3–1.9 employees in other jobs. With a lower level of labour involved in forest management, it is likely that these effects have decreased during the last few decades.

In the 1950s the basic objective in afforestation was to maximize financial returns from real estate assets through wood production and the exploitation of commercial opportunities, using private capital wherever it was appropriate. Investment decisions were primarily made on the basis of discounted net benefit. However, state investments in intervention in afforestation areas could barely be justified by commercial returns alone but were also dependent on environmental and social benefits. Other outputs have become increasingly important. A recent study showed that British forests generated non-market benefits equivalent to £1,000 million per year. Although the population is less dense in Norway, considerable non-market values are also generated here. Optimum investment and management strategies in afforestation areas are still poorly understood – since the works are intermixed with other societal activities. Complex plantation forestry in reforestation areas, designed to maximize social benefits rather than wood production, are still under development in Norwegian afforestation areas - as in afforestation areas elsewhere.

Since most plantations were established in the 1960s and 1970s a large increase in harvestable volume is expected around 2020. In the meantime a wide range of policy tools should be considered to increase the benefits
from afforestation: i.e. further investments in infrastructure, management options and silviculture for new or prolonged rotations, restoration and better combined land use, management of plantations to optimize their value as wildlife habitat, increasing the vitality of small scale companies, etc.

Challenging times lie ahead. International competition will maintain pressure on timber prices for the foreseeable future, commercial tree planting shows no sign of abating, and increasing demands on forests to meet social and environmental objectives will challenge current approaches to forest management. A crucial question is how to affect rural business activities in a positive way to ensure a more efficient outcome of afforestation programs. This field deserves further research and development in the future. All things considered, an optimistic view of the forests in the afforestation districts seems to be fully justified. Throughout history it seems hard to identify any cultures that have faced large problems caused by a surplus of commercially interesting forest resources. However, greater importance should be made in the future on the incorporation of ecological and esthetical aspects into the planning phase of afforestation.
Bibliography


