

If it is likely that the ground gets run over rapidly with weeds, or the soil being dried up much by the sun, the replanting of the ground is done as soon after the removal of the old forest as possible; whilst in localities where the danger from insects, especially from the small beetle (*Curculio pini*), is great, it is preferred to let the ground lie over for two or three years before planting. Planting is done in autumn as well as in spring, but the latter is preferred.

In these hills the spring planting commences at the foot of the hill, and progresses up hill as the weather improves.

Autumn planting, which becomes necessary on account of short spring time, begins in the end of August from above, and continues until the end of September at the latest.

Spruce is usually planted 4 to 5 feet apart, and in many different ways, whichever suits the one or other locality best.

Cultivation of  
spruce on the  
high moors.

On the Bruchberg, about 2,600 feet elevation, I saw very successful and instructive cultivation of spruce on the High Moors. They were in the first instance well drained by a net-work of ditches, and afterwards the plants placed, not in the soil, but on the top of it, on small mounds of earth prepared on the spot, and the roots surrounded with the same, and afterwards the mound covered in with a few sods of turf. This operation was expensive and not expected to repay itself during the first rotation, but the whole area was not only redeemed again for cultivation by it, but the spreading of the moor was prevented.

As the spruce has no deep-going taproot, but spreads her roots more along the surface, the cool and damp surface soil of the mountain suits it particularly well. Under moderate shade—such as, for instance, the oak and Scotch fir afford—it also thrives well, but its own foliage is so dense that nothing else can be grown under it. It thrives, however, remarkably well in company of the beech, and then produces exceptionally fine and large timber.

Danger the  
spruce is  
exposed to from  
snow.

At the higher elevations the spruce is frequently broken down by accumulated snow, especially the young and regulated forests, and there are no means of preventing it except by going back to the old irregular mode of management.

From wind.

Another great danger the spruce is exposed to, on account of her roots only spreading in the surface, and for want of a strong taproot, are the storms, which had, in December, 1868, overthrown in some localities trees amounting to seven times the yearly quantum of wood fixed for felling. This renders great care necessary in deciding the direction in which the felling operations should progress.

From insects.

To protect the spruce forests against damages from insects, the forester has to be constantly on the alert, as they are many, and if not checked in time, great damage is done by them. The most destructive kind noticed was the ordinary spruce bark beetle (*Bostrichus typographus*), which attacks the bark of living trees, and had, in some of the localities visited by me, destroyed so many trees that, after the diseased trees had been removed, the forest had become so open that the wind would soon have overthrown the rest if they had not been felled. Experienced men are told off to guard against this danger, by going through the forest to search for the trees attacked by the beetles, and to fell and bark them, so as to prevent the spreading of the insects, and it is considered they are quite master over them. They generally attack trees loosened in their roots by wind, and they are easily known after the beetle gets into them by their foliage turning yellow. In spring, when they are most destructive, healthy living trees are felled at the southern margin of the forests in sunny spots, for the purpose of attracting the beetles. Such trees are frequently full of them within three or four days after having been felled.

The trees attacked by the beetle are barked, whereby the larvæ are destroyed if not already too far advanced: where the latter is the case, the bark is collected and burned. To prevent any of the beetles escaping at the barking of the stem, a cloth is commonly spread under the stem with great advantage.

Another beetle (*Pissodes hercyniæ*) has done great damage in young forests on the Harz Mountains, and has to be watched very closely, and the trees attacked removed at once.

The timber beetle (*Bostrichus lineatus*) which attacks newly-felled trees, and penetrates deep into the wood, is also common in the Harz forests, and has to be watched closely.

For the young plantations of spruce, the beetle (*Curculio pini*) already mentioned is the most destructive, as it attacks the young newly-planted trees very readily, eats off the bark immediately above the root, and thus kills them. They are caught under fresh pieces of bark about one foot square, which are distributed over the ground, and put with the inner side downwards, either before the planting is commenced, or amongst the young trees after it has been completed. These pieces have to be looked over daily, and the beetles collected.

From deer.

The bark of the spruce is also frequently gnawed off by the deer, and places so affected scraped afterwards by men who collect resin. The latter is prohibited, but in one of the places visited, 100 cwts. were seized the winter before last.

General  
management of  
the spruce.

Except in very young and too thickly sown or planted forests, or where other soft wood has sprung up, much thinning out is not required with the spruce, and only those stems should be removed which have got suppressed by the stronger plants.

According to the different altitudes and localities, if more or less suited for it, and the size of the timber most saleable, the length of rotation with the spruce varies from 80 to 120 years.

Whilst the felling and removal of the timber is done one year, the digging up of the rootstocks for charcoal burning is carried on the next, which latter is also an important measure for the succeeding cultivation of the ground.

Of those trees which grow best with the spruce, the silver fir and the beech are the two most important.

Larch, which formerly was often planted with spruce, has lost much of its importance as a forest tree, on account of its deterioration in this part of Germany.

Charcoal  
manufacture.

Under former arrangements, great quantities of wood were made into charcoal for the Government silver and iron mines; but when the latter were required to credit the forests with the real value of such charcoal, they soon made other more economic arrangements, and the result has been that coal is now wisely burnt by this establishment.