FORESTS AND THEIR MANAGEMENT.

We continue our extracts from Mr. R. W. Phipps' report to the Ontario Government:—

FORESTS OF LUSS AND THE HARZ.

Another gentleman, M. Gustav Mann, Conservator of forests in Bengal, has proceeded to Germany for the same purpose as Capt. Walker, and *gives some further important* information relative to the German forests.

In the plain of North Germany the Scotch fir is the principal forest tree, and better suited for deep, loose, sandy, than for heavy loaming soil.

The great "Luneburg Heath" is mentioned as having been covered with wood, but the indifference of the inhabitants to the existence of forests, originating in the common belief that they will continue to exist, no matter how recklessly treated, the desire of the villagers to get grazing ground for their cattle by burning the forests, the indiscriminate usage of the wood and method of felling in vogue, have destroyed hundreds of miles of forest, and have left the greater part of the Luneberg Heath barren, covered almost exclusively with heather, and of little use to any one. Now the evils are seen, and with a view of restoring these forests large sums of money, and much skill and labor, are being expended.

I will quote here a short description of the method used in planting the Scotch fir in such localities. The land is first ploughed, after which a man proceeds along the bed, making holes at distances three feet by five, with a wedge spade (one quite straight, made all of wood except the edge, which is shod some inches high with iron, and is two inches thick at the top of the blade). This he forces into the ground, withdraws it, and passes on, while two women follow him, who plant by holding the seedling against one side of the hole, while with their foot they press the opposite earth against the plant. The material for planting consists of one-year old seedlings of Scotch fir, and occasionally a two-year old seedling of spruce, which are raised in the ordinary way by sowing in furrows. The Scotch fir requires more light and air than any other, and does not thrive at all in the shade of other forest trees. For the same reason natural reproduction (in forests) is very difficult, and not attempted here. As a tree affording some shade to other trees which require it the Scotch fir is well suited. If sown or planted very close, early attention to thinning out also is necessary, as plants early stunted never fully recover their strength. The soil not being rich, the trees are not allowed to grow older than sixty to eighty years, this being the age at which the comparative yield of wood is best. Spruce is planted in small numbers with the Scotch fir, and even where the soil is not good enough for it to grow up into large trees with the fir, it becomes beneficial by the cover of its dense foliage, which facilitates decomposition of the soil, and keeps it moister and cooler than the fir alone could do.

It will, perhaps, be as well here to give Mr. Mann's very lucid description of beech culture:—

Seed beds for beech are prepared in the ordinary way, and the seed is sown in autumn as well as in spring. If the former time is preferred, care has to be taken that the seed does not germinate too early, so as to be exposed to spring frosts. This is prevented by covering over the beds after the surface gets slightly frozen, and by removing the covering in spring so late that the young seedlings have nothing more to fear from the frost. If sown in spring, the seed has to be carefully stored during the winter. Steaming, as well as excessive drying, must be guarded against. The first is avoided by turning over the seed or even keeping it spread out; the second by slightly watering it and turning it over afterwards, so as to distribute the moisture equally. A cool, moist room on the ground floor is preferable to a warm dry one.

From the seed beds the plants are either removed at once into the forest, or into other nurseries for transplanting and keeping until they reach a height of three or four feet. If they are to be planted in open ground, without the protection of old trees, they are sometimes kept in the nursery until they reach a height of ten or twelve feet, which however is a very expensive measure. In this care is taken that the young shoots are not removed from the stem, as the bark of the beech is very easily burnt by the sun, and otherwise apt to be damaged by the weather. Unnecessary exposure of the roots of the young beech is carefully avoided, as they are sensitive, and demand special care during the removal of the plants. Where it can be done some of the soil is left on the roots for the same reason.

Ordinarily the beech forest trees get re established by natural production, *i. e.*, the shedding of seed from old trees. When the beech gets mixed with other kinds, as in the coppice with standard, its regeneration is furthered or checked according to circumstances, but planting is seldom resorted to.

In the pure, high forests of beech the natural reproduction is brought about by gradual and well considered fellings, which tend to effect this as completely as possible. In hilly or mountainous localities fellings are commenced at the top of the hill. These fellings take place when the trees have reached maturity, and are three to four in number, and distinguished according to the immediate effect they are intended to have on the forest.

The first felling called in Germany the preparatory cutting, is intended to facilitate the decomposition of the dry leaves and branches which cover the surface, and thus prepare it for the reception of the seed, which latter, without this precaution, frequently germinates without being able to penetrate with its roots the comparatively hard and leathery leaves lying on the surface, and often dies in consequence, while weeds and scrub easily get up in it, and cover the surface soon, thus adding to the difficulties to be overcome by the young plants. It is commenced several years before the intended regeneration, and carried out gradually; but where the air and light thus admitted are not sufficient to render the surface fit for the reception of the seed, a timely permission to villagers to remove some of the dead leaves is resorted to. Besides the preparing of the soil, this opening out of the forest induces the tree to flower and bear seed more frequently than when standing very close.

The second felling—the so-called seed-cutting—is carried out as soon as the bearing of the seed becomes probable, which can be judged of beforehand by the appearance and shape of the buds during the preceding winter. An abundant seed-bearing season generally occurs with the seed after longer or shorter intervals, but sufficient seed for the regeneration of the forests may be reckoned on every second or third year. Precaution is used not to remove too many trees at once, as in the case of the flowers being destroyed by spring frosts or other causes, the restocking of the ground with young plants does not succeed. Too much light would dry up the surface of the soil, and induce the weeds to overrun the ground, both circumstances seriously interfering with the germination of the seed at a future season. Where at this time the suitability of the soil remains doubtful, a timely loosening and preparing of it in stripes and patches is resorted to to insure success.

When the expected seeding of the trees turns out a failure, further clearing is carefully avoided, to prevent the deterioration of the soil or overgrowing with weeds. If, however, the season is a favorable one, and produces sufficient seed, and the young plants germinate, this felling is soon extended to a greater number of trees to admit more light and dew to strengthen the young plants.

For the purpose of getting the seed worked in to the ground, herds of swine, cattle, etc., are often driven through the forest with good effect.

Seed beds are sometimes established in the neighborhood of a forest at the same time, to furnish young plants for the filling up of vacancies, which, however, are also obtained nearly as good out of the forest itself from places where the plants stand thick enough. Although the aiding of the natural reproduction by artificial means, either sowing or planting, is at the present time generally resorted to at once, as such measures always lead to a more satisfactory accomplishment of the desired regeneration, and save time.

The third felling is called cutting for light, as its chief purpose is to admit light and air in greater abundance as the young plants require it. This is generally commenced when the seedlings are two years old. It is also regulated very much by circumstances, and while in the one case the forest trees may be required longer on account of the spring frosts, so very injurious to the young beech, in others their early removal is necessary, even if an increase in size be sacrificed, for the establishment of the young trees. Neither do partial failures prevent the removal of the old trees, but are resorted to at once by sowing or planting as the safest and quickest mode of securing the establishment of the young forest.

After the third or light felling follows the gradual removal of the old trees, or final clearing, which is regulated in the first instance also by the requirements of the young trees, and after this by the fixed yearly out-turn, as laid down in the working plan. As a general rule, all these fellings are carried out gradually, without causing sudden changes in the forests. The aiding of natural reproduction is either accomplished by sowing, if failures are precipitable early, such as non-germination of the seed or death of the seedlings; or by planting, if the seedlings get destroyed later by spring frosts or are choked by weeds. The sowing is carried out in the forest in strips two feet wide, in furrows, or in patches two to three feet square, prepared by hoeing for the purpose, and by loosening and levelling of the soil; while planting is done by seedlings two to three feet in height taken from adjoining nursery beds, or from spots in the forest where there are more than are necessary.

"It is evident," says Mr. Mann, "that if, with all this care and attention to aid natural reproduction, still occasional failures occur, how unreasonable it is to expect forests in India to keep in an equally rich and thriving condition when left to themselves, or worked only with a view of extracting the timber from them." I would also apply the remark to Canada, and observe also that Captain Clarke respecting India, and the Hon. M. Joly concerning Canada, make precisely the same statement, to the effect that the forests in both countries, cut over and carelessly managed, are often, so far as any available supply of good timber is concerned, only in appearance.

It may be noticed that the beech of all other trees, is said to improve the land, forming a rich vegetable mould, to gain the benefit of which other trees—oak, ash, maple, larch, Scotch fir—are planted among the beeches and do well. I may notice here that in Canada, while clearing the forest this did not appear to me. I generally found the maple on the richest land, and where beech were intermixed a lighter loam.

One description of forest much used in Germany is called "Middle Forest. It contains a number of high trees cut at long intervals for timber, and below them a coppice (smaller trees growing from roots of previously existing trees, and which will themselves, when cut, be succeeded by similar ones) cut at much shorter periods for firewood. In cutting the coppice, young trees are left to replace the tall ones when cut.

A method of planting used here should be noticed. A small spade of solid iron, about 20 pounds in weight, 14 inches long, seven inches broad at top, five at bottom, with a handle four inches long, is driven in the ground and bent to all sides then drawn out. The plant, three or four years old, of beech, spruce, or oak, etc., is dipped into a thin mixture of loam and water, which adheres easily. In this state it is pushed with its roots into the hole as far as possible, and with continual shaking, by which the roots get straight right down into the hole, drawn up to the level at which the plant should stand. Here it is held by one man, while another drives in the spade a second time, about three inches from the first hole and parallel with it, and first presses with its point towards the first hole, and then with the broader part, by which means the plant gets very firmly pressed into the soil. If necessary the spade is driven in a third time, to close up the second hole slightly. The soil is then beaten firm with a mallet all around the plant, but not striking closer than three inches. This mode is very successful; it is carried on without preparing the soil, and answers in stony ground, on account of the strength of the spade.

On the Harz Mountains (the scene of many a supernatural legend) are vast forests of spruce, kept with much care. One remarkable point in the management is the Government seed-dying kiln at Westerhof, for getting the spruce seed out of the cones and cleaning it of wings, which is carried on here extensively, the spruce being plentiful, of excellent growth, and producing exceptionally good seed. The cones are collected by contract work, and varies according to the seasons, if plentiful or otherwise, and generally enables the workmen to earn 50 cents to 75 cents per day. After all the Government stores are filled, private persons are allowed to collect, for which the person has to pay a small sum per season. In the cones the seed remains good from seven to eight years. The Government kiln turns out about 180 cwt. per season, while private parties in good seasons have turned out as much as 1,600 cwts. besides. The cones, when first brought in, are stored in large rooms, with perforated walls, so as to admit a free current of air through them.

The kiln itself consists of three rooms, the centre one of which is heated by means of a large oven, from which large iron pipes, six inches in diameter, pass twice through the room before they enter the chimney. This room is separated by walls, in which there are holes of nine inches, from the two outer rooms, in which the cones are being dried. By means of these holes, which can be closed at pleasure, the temperature in the drying room is regulated, and kept between 122 and 128 Fahrenheit. The drying is done in large wire dums, out of which the seed falls on the floor of the room. There are twelve in each room, and are turned from the outside of the room, where it is cooler. They are filled in the evening, the temperature got up, and so left for the night. The next morning the fire is lit again, and the drums being turned every half hour, by night the cones are empty. Half the cones are used to heat the kiln; the rest sold for fuel. It costs the Government about six cents per pound. What is not needed is sold at nine.

It is noticeable that the spruce wood, among other uses, is ground up into pulp for paper manufacture, several mills in the Harz Mountains being employed in this manner. It might be worth consideration whether, under an improved system of forestry, the waste wood left in such quantities in hewing and score-hacking could be, in our great Canadian spruce forests, so employed.

It will be well to give an account of the method of reproducing and caring for spruce forests, both because our own forests will soon need replanting, and to give some idea of the care taken in maintaining woodland property in foreign lands.

Natural reproduction of the spruce is seldom attempted, as too slow and uncertain; but if there are thriving naturally some clumps of any extent, they are kept up. Almost all spruce forests are regulated high forests, with complete clearings, either re-sown, which is still preferred by some, or planted, which is by far the most general mode of establishing or re-establishing spruce forests. If sown, lines about two feet in width are prepared by clearing the weeds, etc., off the ground, and placing this at edge of the lines to prevent the wind blowing among the seed, or rain washing them off. The soil on these strips is sometimes loosened and left as it is if the seed is to be sown broadcast. If the seed is sown in rows, small furrows are made. Between the strips, ground twice as wide is left. For plantations, the seed is sown in seed-beds, which are good, even, and sheltered pieces of land, about half an acre in size, and well dug up, afterwards levelled and occasionally slightly manured by the ashes of the weeds, remains of wood, etc., collected on the surface, brought together and burned, and afterwards mixed with the soil. These seed-beds are usually in the immediate neighborhood of the ground to be planted, and have to be fenced in. If the seedlings, after they are three or four years old, have to be removed from here at once to the spot where they are to remain, the seed-beds have to be larger, especially if the young plants are to be planted out in numbers,