

Messrs Graham and Lockhart further state, that, on their suggestion, Mr Maclean has agreed to try, upon a large scale, this season, those substances which proved most remunerative last one, and to mark, throughout a rotation of crops, the future effects upon any of the plots of ground, of those substances he has already applied, or may hereafter make the subject of experiment.

In conclusion, they further throw out a suggestion, the advantages of which are very obvious. They recommend that some member of the society should inspect the ground intended for experiment, *before* the application of the manures, at least *once more* during the progress of the crops to maturity, and *again* when under the process of being harvested; and that this should be imperative in all cases where any premiums of this description are offered by the society for competition; but that the report by such member should be separate and distinct from the report and minute details which must still continue to be supplied as at present by the competitors for the premiums offered by the society.

REPORT ON YOUNG PLANTATIONS, chiefly formed within the last Five Years, on the Estates of his Grace the DUKE of SUTHERLAND, in the County of Sutherland, under the Direction of JAMES LOCH, Esq., M.P.

[Premium, the Gold Medal.]

The advantages of planting waste lands are now so fully understood and appreciated, that any enumeration of them is, in the present instance, deemed unnecessary; and, in the following report, it is therefore intended to limit the remarks as much as possible to the information requested by the Highland and Agricultural Society, under the different heads of expense; description of soil; ages and kinds of trees planted; number of each sort per acre; mode of planting; extent of beeting up; progress of the plantations; and general observations suggested by experience and present appearance of the plants, after prefixing a few separate notices relative to the different plantations.

The plantations newly or recently formed on the Sutherland estates, contain in all 2,091 imperial acres, of which 1859 acres have been planted within the last five years, or since autumn 1837, and the remainder at different times prior to that, and posterior to the commencement of 1836. These plantations occupy different altitudes, varying from 50 to upwards of 1000 feet above the level of the sea, and are situated in the parishes of

Golspie, Dornoch, Clyne and Creich, on the north-west shore of the Dornoch Firth, and in the vicinity of the 58° north latitude, a district exposed to the sea-breezes off the Moray Firth, but possessing a comparatively mild climate; being defended from the more violent winds of the north and western oceans, by successive mountains and uplands of considerable elevation.

*Separate Notices Relative to the Different Plantations.*

1st, *Duchess Mound Plantation*, situated in the parish of Golspie, and within two miles of the sea. The soil, in part, consists of peat mixed with sand, and the remainder is a rich loam, lying on old red sandstone conglomerate, the general surface forming a steep slope with a southern exposure, and varying in altitude from about 50 to 150 feet above tide-mark. In 1835, it was enclosed with a turf dyke, five and a-half feet high, by five feet wide at bottom, and one and a-half foot at top, the formation of which cost 2s. 9d. per lineal rood of six yards; and, as a further protection against the inroads of sheep, a single bar of paling was put on the top, the erection of which cost 1½d. per lineal rood of six yards. The dry nature and sloping form of the ground, rendered a less than average amount of drains necessary. These consisted of leaders and feeders; the former twenty-four inches deep, by thirty-six inches at top, and ten inches at bottom, the construction of which cost 9d. per rood; and the latter, nine inches deep, by twenty-four inches at top, and ten inches at bottom, which cost 3d. per rood. The whole was planted in autumn 1836, with two-year seedling Scots fir, one and two year transplanted larch, and one, two, and three year transplanted hard-wood.

2d, *Drumdivan Plantation*, in the parish of Dornoch, and in the immediate vicinity of the sea, is sheltered on the west by old plantations; and throughout about two-thirds of its extent, consists of very light sandy soil on a sandy bottom, and is so level that considerable difficulty was encountered in getting it effectually drained. The remaining third is a dry sloping loose gravelly bank, and the whole is enclosed with a turf dyke of like dimensions with the last. In 1831 and 1832, the level ground was planted with larch, but with very indifferent success, from the want of sufficient draining; and, in 1836 and 1837, the whole was redrained and planted with two-year seedling Scots fir, one and two year transplanted larch, with a quantity of two-year transplanted elm and ash, on about two acres, which were formerly under culture.

3d, *Skelbo New Plantation*, in the parish of Dornoch, consists throughout of a light soil, on a gravel or clay bottom, with a

northern exposure, but sheltered by old plantations. The whole of the ground in this instance was formerly arable, and partly enclosed. In 1836 the enclosures were completed, and the whole planted with two-year transplanted larch and hardwood, chiefly oak, any failures among which were made up with two-year transplanted birch in 1840.

4th, *East Clackmore Plantation*, also in the parish of Dornoch, is situated about four miles inland, on a rising ground, attaining to an altitude of about 150 feet above the sea, having both a northern and southern exposure. The soil is in general of a light gravelly nature, occasionally mixed with peat or clay, and incumbent on a gravelly or clay subsoil; formerly about two-thirds of the whole was arable, and the remainder covered with black heath. In 1829 the latter portion was broken up with the plough, and sown with Scots fir seed, at the rate of 4 lb per acre, which proved an entire failure. The whole was surrounded by a dry stone dyke, five feet in height, the building of which cost 10s. per lineal rood of six yards; and, after being thoroughly drained, about one-half was planted in 1836 with two-year seedling Scots fir, and the other half with two-year transplanted larch and hardwood.

5th, *Black Park Plantation*, parish of Golspie, having a north and north-east exposure, is about a quarter of a mile distant from the sea, and from 100 to 350 feet above its level. The soil is in general light, resting on a loose sandy bottom, on red sandstone rock. In 1816 and 1817 it was sown with 4 lb of Scots fir seed per acre, which, however, afforded a very indifferent brail of young plants, and most of these perished in the succeeding winters; but the few which remained continued to do well. In 1838 and 1839 it was drained at a considerable expense, and planted with two, and a few three year seedling Scots firs, these being sorted into small, middling, and large sizes, and slit-planted into separate patches; the results of which were, that the large almost entirely disappeared within the first year. The middle-sized showed a considerable portion of sickly plants, and the smallest proved the most healthy; part of both these last, however, died off in the course of the succeeding winter, and were again replaced with similar plants; and although both now appear very similar, yet the presumption is in favour of small plants, if healthy and well rooted, for exposed situations.

6th, *Badderhvie Hill Plantation*, in the parish of Creich, is situated on a hill ranging, in altitude, from 150 to 450 feet above the level of, and about twelve miles distant from, the open sea, having a northerly exposure. Towards the top of the hill the soil is light, partly on a hard clay or till, and partly on a gravelly subsoil; and on the lower parts it is chiefly composed

of a coarse loam or loam and gravel. The higher parts, which still bear the remains of an old Scots fir wood, was planted in 1837 and 1838, with two-year seedling larch and Scots fir; and the lower grounds with two-year transplanted larch.

7th, *Duke's Plantation*, in the parish of Dornoch, contains a considerable diversity of soil, but it is generally of a peaty nature, mixed with a greater or less proportion of sand or gravel, and, for the most part, on a clay sub-soil, but in some parts also on gravel—the former being usually underlain by a stratum of hard till or pan. In altitude, this plantation varies from 60 to 200 feet above high tide-mark, and is situated about three miles from the open sea, with an exposure on all sides except the west. In 1833 and 1834 it was surrounded with a turf fence, and thereafter imperfectly drained and planted; but the results were in the highest degree unsatisfactory, until redrained with considerable care in 1838; and in that and the following seasons it was replanted with two-year seedling larch and Scots fir, one and two year transplanted larch, and, in the best soils, 20,000 two-year transplanted spruce. Different portions were also planted with oaks, intermixed with birch, as nurses, the present appearance of which does not warrant a continuance of the practice, especially in such ungenial situations.

8th, *Duchess-Countess Plantation*, in the parish of Dornoch, has a southern exposure, with a thin light soil, and hard clay or gravelly subsoil, in the higher parts, and in the lower situations a loamy soil on sandy clay. It varies in elevation from 60 to 250 feet above high tide, and is about one mile from the sea. In 1838 and 1839, it was thoroughly drained, and enclosed on three sides by a turf dyke, (of like dimensions as described in No. 1,) and on the other side, where it is bounded by arable land, by a stone-faced dyke, five feet high, which cost 10s. per lineal rood; after which, in 1839 and 1840, it was planted with two-year seedling larch, Scots fir, and a few black Austrian pine, and one and two year transplanted ash, beech, elm, and oak, with a few mountain ash, poplar, and alder.

9th, *Pole's Plantation*, adjoining the west side of the last—the higher parts of which it resembles in soil and exposure. About eighty acres of it were planted in 1834, but with very indifferent success; and in 1837 the same was replanted, and is now looking well. In autumn 1841, the remaining fifty acres were added to the enclosure, and thoroughly dried with open drains, as described in No. 1; and, in February last, this portion was slit-planted with three-year seedling spruce, and two-year seedling larch and Scots fir.

10th, *Everet New Plantation*, in the parish of Dornoch, and

79/92

78/92

within a mile of the sea, contains about ten acres of level-lying light soil, on a loose gravelly bottom, and was planted, in spring 1841, with two-year seedling larch and Scots fir, in the proportions of about one-fourth of the former and three-fourths of the latter. It is sheltered by the old plantations of Sidera, in the vacant parts of which about 5,000 larch and 100,000 two-year seedling Scots fir have been planted within the last three years.

11th, *Kilcolmkill New Plantation*, in the parish of Clync, and district of Strathbrora, about six miles inland, and from 50 to 150 feet above the level of the sea, is also in part sheltered by old plantations, and has a fine light soil on loose gravel, with a southern exposure, and was slit-planted with two-year seedling Scotch fir in 1840. On a large extent of ground adjoining this plantation, and protected from cattle and sheep by a four-bar paling, is growing a very fine and pretty regular crop of self-sown Scots fir, from the seed of the old plantations of Kilcolmkill.

12th, *Ben-Bhragie Plantation*, in the parish of Golspie, is situated on a hill of that name, fully more than a mile from the sea, and exposed on all sides, except small portions in the vicinity of old plantations, which occupy the lower grounds on part of the north-east and south sides. The elevation ranges from 200 to upwards of 1000 feet above high tide mark. The prevailing rock is a quartz red sandstone conglomerate, and the soil consists of almost all the varieties to be met with in the district. In 1840-1-2 the whole was planted with larch, Scots fir, spruce, silver-fir, and hardwood, consisting of oak, ash, elm, sycamore, Norway maple, hornbeam, mountain ash, poplars, &c., and, so far as can yet be judged, the silver-fir and Norway maple seem to withstand the sea-winds best; but it will still take some years before any definite opinion on the subject can be formed.

13th, *Harriot Plantation*, parish of Dornoch, is intended to comprehend about 680 acres, and lies on the top of a hill from 200 to 600 feet above the sea, from which it is distant about two miles. The prevailing rock is gneiss, and the soil consists in some parts of a poor thin peat on loose gravel and hard clay, in others of a sandy peat on gravel, and in certain localities of a thin poor loam on soft clay, &c. In 1841, about 240 acres were enclosed and drained, and in 1842 the same was planted with two-year seedling larch and Scots fir, one-year transplanted larch, together with a few three-year seedling and two-year transplanted spruce.

14th, *Mr Loch's Plantation*, in the parish of Dornoch, was enclosed and drained in 1841. A great portion of it lay formerly entirely under water, and, in some of the drier parts, considerable numbers of self-sown Scots firs have sprung up. At

present (autumn, 1842) the planting of it with two-year seedling Scots fir is commenced, and is expected to be completed before the end of December.

15th, *Sundries*.—Under this head are included several patches, varying from two to four acres in extent, which have been executed at a considerable expense, for the purpose of completing older plantations, or effecting improvements in the landscape, and which have chiefly been planted with large transplanted plants of almost all the different sorts previously enumerated.

TABLE 1.—*Shewing the Expenses of Enclosing, Draining, and Planting.*

Names of Plantations.	Dates of Planting	Contents in Acres	Enclosing.	Draining.	Planting.		Total.
					First Planting.	Beeting up.	
1 Duchess Mound,	1836	40	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.
2 Brundivan, . .	1836-7	100	32 9 6	27 0 9	26 10 0	0 10 0	86 10 3
3 Kelbo, New, . .	1836	20	62 10 0	4 14 0	17 3 0	not done	84 7 0
4 East Chashmore,	1836	20	40 0 0	2 0 0	34 14 9	1 1 0	77 15 9
5 Black Park, . .	1836-9	72	unascertained	7 0 0	45 14 0	none required	52 14 0
6 Babblerhaie Hill,	1837-8	141	do.	136 7 4	25 4 0	4 0 0	165 11 4
7 Duke's, . . . .	1837-8	40	20 0 0	3 0 0	4 0 0	none required	27 0 0
8 Duchess-Countess,	1838-9-40	300	149 7 0	72 3 8	71 0 0	not done	292 10 1
9 Pole's, . . . .	1839-40	230	193 8 11	49 19 7	102 15 0	6 0 0	351 3 6
10 Erelex, New, . .	1836-42	130	102 2 4	24 0 0	65 15 0	none required	211 17 4
11 Kilcolmkill, New,	1841	10	15 0 0	none	1 0 0	do.	16 0 0
12 Ben-Bhragie, New	1840	10	none required	none	1 5 0	do.	1 5 0
13 Harriot, . . . .	1840-1-2	600	134 6 5	260 12 9	132 10 0	not done	527 9 2
14 Mr Loch's, . . .	1842	210	160 0 0	77 15 1	48 10 0	do.	285 15 1
15 Sundries, . . . .	1841-2	140	113 8 5	40 18 8	not done	do.	161 7 1
	1838-42	15	unascertained	unascertained	unascertained	do.	
	2091			Total ascertained expense,			2314 6 2

*Expenses.*—The outlay attendant upon the different operations of enclosing, draining, planting, and beeting up, (so far as the latter has yet been performed,) is exhibited in the foregoing Table No. 1. The value of plants being, however, subject to considerable fluctuation, and many of those used being reared on the property, their exact cost cannot now, from various causes, be distinctly ascertained; that portion of the expenditure is therefore entirely omitted. Parties desirous, however, of such information, may easily supply this apparent defect by taking the trouble to calculate their value at existing or given rates, with the aid of Tables Nos. 2 and 3, which contain the kinds and quantities used.

*Description of Soil.*—From the number and varied localities of the plantations, considerable diversity exists in their soils. These are, in general, however, incumbent on old red sandstone, gneiss, and gravel; of the latter of which, in their constituent parts,

they in general partake to a greater or less extent, with the exception of certain parts where pure moss or peat predominates, as is more minutely described in the separate notices relative to the different plantations.

*Ages and kinds of trees planted.*—The particulars relating to this head will also be stated more fully under that of separate notices relative to the different plantations in Table No. 2, by which it will be seen that the kinds planted consist of larch, Scotch fir, Norway spruce, and hardwood of various sorts—as oak, beech, ash, elm, birch, alder, &c. The ages of these were, in general, as follows:—Larch, two-year-old seedlings, as also one and two year transplanted; Scots fir, two and three year seedling, and one and two years transplanted; spruce, two and three years seedling, and two years transplanted; and hardwood, either one, two, or three years transplanted.

TABLE 2—Number of each sort Planted per Acre.

No.	Names of Plantations.	Dates of Planting.	Contents in Imperial Acres.	No. of Plants per acre.				Number of each sort in Plantations.				Total.
				Hard-wood.	Larch.	Scots Fir.	Spruce.	Hard-wood.	Larch.	Scots Fir.	Spruce.	
1	Duchess Mound.	1836	40	2500	3000	1000	3000	25,000	26,000	80,000	4,000	135,000
2	Drumdivan.	1836-7	100	2000	3000	1500	3000	4,000	84,000	292,400	6,000	386,000
3	Skelbo, New.	1836	20	2300	3000	none	none	23,000	30,000	none	none	53,000
4	East Clashmore.	1836	72	2000	3000	1500	none	20,000	60,000	190,000	none	260,000
5	Black Park.	1838-9	144	none	none	5000	none	none	none	720,000	none	720,000
6	Badderhuie Hill.	1837-8	40	none	2000	1000	none	none	30,000	100,000	none	130,000
7	Duke's.	1838-9-40	300	none	2700	5000	2700	none	200,000	1,100,000	16,000	1,316,000
8	Duchess-Countess.	1839-40	230	2500	3000	1300	3000	50,000	200,000	559,000	10,000	919,000
9	Pole's.	1836-42	130	none	3000	1000	3000	none	90,000	400,000	6,000	496,000
10	Evelex, New.	1841	10	none	2300	1000	none	none	6,900	23,000	none	29,900
11	Kilcolmkill, New.	1840	10	none	none	3000	none	none	none	30,000	none	30,000
12	Ben-Bhragie, New.	1841-1-2	600	2500	3600	5000	3600	200,000	300,000	2,100,000	60,000	2,660,000
13	Harriot.	1842	240	none	2600	1400	2600	none	230,000	616,000	30,000	876,000
14	Mr Loch's.	1840	140	none	2600	1000	2600	none	none	none	none	unfit for use
15	Sundries.	1838-42	15	2000	none	none	none	30,000	none	none	none	30,000

*Mode of Planting.*—As a general rule, all seedling larches and Scotch firs were planted in the common or T slit manner, with the common garden spade; and, in certain situations, where the ground was of a tenacious or hard texture, slits were made thus ††, for the purpose of loosening the soil, which practice has been found to produce a decidedly beneficial effect. For the transplanted larches, Scots fir, and hardwood, pit-planting was in general at first resorted to; but where such was practised in tenacious soils, many of the plants were found to be raised, and in not a few instances entirely thrown out by the frosts in winter; and even those which retained their hold were found to have suffered considerably from the action of the sun to the pit and

these acting as reservoirs in keeping it about their roots during wet weather; in consequence of which, slit-planting in one or other of the above-described forms was adopted in such soils, when the plants were not of too large a size for that operation; and, whenever carefully performed, the appearance of the young trees is decidedly in favour of such a practice. In some few places, where a stratum of muirband pan, or bog iron-ore, was found to exist between the soil and subsoil, a pick, constructed for the purpose, was used for breaking through the same, and stirring the subsoil to a depth of about six inches beneath. In such situations, the present appearance of the young plants is highly favourable; and the localities have been marked, with a view to ascertain the ultimate results.

*Extent of Beeting up.*—From various unforeseen causes, the extent of beeting up in the different localities has been very various; and the following Table No. 3, shews in how far this portion of the work has been completed; and, for additional particulars, see separate notices relative to the different plantations.

TABLE 3—Shewing the Extent Beet up.

No.	Names of Plantations.	Dates of Planting.	Extent in Imperial acres.	Number of each sort used in Beeting up.				Remarks.
				Hard-wood.	Larch.	Scots Fir.	Spruce.	
1	Duchess Mound.	1836	40	...	...	10,000	...	Completed.
2	Drumdivan.	1836-7	100	...	...	...	...	Not done.
3	Skelbo, New.	1836	20	3000	...	...	...	Completed.
4	East Clashmore.	1836	72	...	...	...	...	None required.
5	Black Park.	1838-9	144	...	...	80,000	...	Incomplete.
6	Badderhuie Hill.	1837-8	40	...	...	...	...	None required.
7	Duke's.	1838-9-40	300	...	...	...	...	A good deal requisite.
8	Duchess-Countess.	1839-40	230	8000	30,000	...	...	Incomplete.
9	Pole's.	1836-42	130	...	...	...	...	Not done.
10	Evelex New.	1841	10	...	...	...	...	None required.
11	Kilcolmkill, New.	1840	10	...	...	...	...	None required.
12	Ben-Bhragie, New.	1840-1-2	600	...	...	...	...	A good deal requisite.
13	Harriot.	1842	240	...	...	...	...	Very little required.
14	Mr Loch's.	1840	140	...	...	...	...	...
15	Sundries.	1838-42	15	...	...	...	...	None required.

*Progress of the Plantations.*—In so far as can yet be judged, the general appearance of the young plants is favourable, except on certain situations where the ground is still too wet, it having been found impossible to calculate exactly the effects of the drains at the time of their formation. In No. 1, the firs and larches generally look well; and a portion of the hardwood, which was put down in 1839, continues annually to produce good healthy shoots. In No. 2, the small portion of hardwood for which, both from the effect of the drought, and by a pool at

the lowest level ground, of very limited extent, the firs appear sickly, from a continued over-abundance of moisture. No. 3, the ground in which was formerly under cultivation, assumed a beautiful and regular growth the first season, which has ever since continued, thereby shewing the beneficial effects, on young plants, from having the ground previously prepared. No. 4 also presents a very satisfactory appearance, especially in the parts formerly arable. Taking the altitude and exposure of No. 5 into consideration, the general appearance of the young plants is satisfactory; and in the comparatively small plantation, No. 6, they are so in the highest degree. On about two-thirds of No. 7, the plants of all are doing well; but in the remaining portion, the ground is still much too damp, and is consequently to be redrained. In the higher parts of No. 8, the firs at first made but little progress, but are now doing better; and in the same plantation, the first planted larches suffered severely from hares, which have now been considerably thinned, and the trees they destroyed replaced. No. 9 now appears to be pretty effectually drained; and the plants put in last spring are looking well. Draining was at first deemed unnecessary in No. 10, the appearance of which is good, with the exception of a very small portion where a few drains will yet be required. In No. 11, the plants appear remarkably healthy, and in the large plantation, No. 12, the general appearance fully equals previously formed expectations; but from the diversity in its soil and altitude, as also in the kinds of plants used, considerable difference in the ultimate success of the trees may be looked for; and a further drainage must still be effected in certain parts. No. 13 having been planted last spring, it can only be remarked in regard to it, that the plants have in general held well, and from the favourable nature of the past summer, (1842,) they have made fully better than the ordinary length of shoots.

*General Observations suggested by Experience and present appearance of the Plants.*

In reference to the practice of sowing Scots fir seed, which was tried in 1816-17 and 1829, in Nos. 4 and 5, it may be remarked that the almost complete failure of these experiments seems attributable in part to the soil being of too wet and unequal a nature; and, further, to the liability of such soils, when ploughed or broken up, of casting or throwing out small seedling plants when acted upon by the winter and spring frosts. In confirmation of these remarks, it may be noticed that the soil on which the young self-sown wood is growing at Kilcolmkill, No. 11 is of a fine light dry nature, on a gravelly bottom; and that the young plants had the additional advantage of being protected from the rigour of winter by the short heath. In the dis-

tribution of the different kinds of plants, attention was paid to selecting for each sort the soils most congenial to its habits; thus larch is, in general, planted on the higher and dry grounds; Scots fir on those of a deeper and more moist nature, and spruce on the dampest, and such as contain a considerable proportion of peat in their composition; consequently they have the appearance of being distributed in irregular masses—a practice also in most instances adhered to in planting the hardwood.

For the purpose of facilitating the after removal of thinning and other timber from the larger plantations, as well as for admitting free access to them at all times, roads and drives have been left throughout at convenient distances; experience having shewn that when the formation of these is delayed till required it is then scarcely possible to select the most eligible situations, especially on ground where the surface is naturally much varied. The extent of Ben-Bhragie plantation, No. 12, conjoined with the unusual diversity of soil, altitude, and exposure which it presents, points it out as being especially suited for the formation of an *arboretum*, and it is, therefore, in contemplation, in furtherance of the views of the Highland and Agricultural Society, as detailed in their list of premiums for the present year, 1842, (Class viii. No 7,) to form upon it a collection of the forest and ornamental trees capable, or supposed capable, of succeeding in the climate of North Britain.

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ON PROTECTION FOR SHEEP.

I.—By ROBERT M'TURK, Esq., Hasting's Hall, Dumfriesshire.

THE practice of affording protection to sheep against the severities of the climate, in cold and exposed districts, is as old as any of those other expedients which man has found it necessary to adopt for the preservation and improvement of so valuable an animal. After exhausting every practicable means of yielding protection and shelter, by the erection of stells, &c., it was still found that some more constant and effectual method was necessary, and salving was resorted to as the cheapest and most likely way of attaining three important objects—namely, to defend the animal from the cold, from the ravages of the scab, and to destroy the vermin which the heat of the summer and the warmth of the fleece have alike a tendency to produce.

With regard to all these objects, it has, to a certain extent, been found to answer the end in view. The expense of the materials, however, and the tinge communicated to the fleece by