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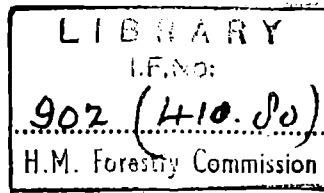
MARGAM

FOREST

SCW) CONSERVANCY

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FORESTRY . COMMISSION

HISTORY

of

MARGAM      FOREST

1921 - 1951

SOUTH (WALES) CONSERVANCY

HISTORY OF MARGAM FOREST

	<u>CONTENTS</u>	<u>Page</u>
CHAIRMAN'S COMMENTS	... ..	1
GENERAL DESCRIPTION OF THE FOREST	... ..	3
Situation	... ..	3
Area and Utilisation	... ..	3
Physiography	... ..	6
Geology and Soils	... ..	7
Vegetation	... ..	7
Meteorology	... ..	8
Risks	... ..	8
Roads	... ..	10
Labour	... ..	11
SILVICULTURE	... ..	12
Preparation of Ground	... ..	12
Choice of Species	... ..	13
Planting	... ..	16
Spacing	... ..	16
Type of plants used	... ..	16
Methods of Planting	... ..	16
Rate of Planting	... ..	17
Success or otherwise of Establishment	... ..	18
Ploughing	... ..	18
Beating Up	... ..	20
Weeding	... ..	21
Mixtures	... ..	21
Rates of Growth	... ..	22
Past Treatment of Established Plantations - Thinning		24
Research	... ..	25
Conclusions	... ..	25
APPENDICES		
I Notes from Inspection Reports	... ..	27
II Record of Supervisory Staff	... ..	33
III Acquisition Details	... ..	35

	<u>Page</u>
IV Summary of Silvicultural Data from war time	
fellings compiled in 1942 ... ..	36
V Report of Meeting held at the Divisional Office	
(9) on 28th July, 1937 ... ..	38
VI Map of the Forest.	

## HISTORY OF MARGAM FOREST

### CHAIRMAN'S COMMENTS

This is an excellent account of what has occurred in a very difficult afforestation area. The work got off to a bad start which can be condoned on the grounds of inexperience in dealing with the local conditions. That applies primarily to choice of species but there were also errors in routine silvicultural work, such as neglect of weeding and unintelligent beating up, which might have been avoided. On top of this came the disastrous record of fire damage. I have always felt that some of it was due to incendiarism, which was impossible to prove, and that in fire-fighting reckless use was made of back-firing (on the occasion of the first large fire at least), so increasing the areas burned.

The cumulative effect was depressing and over all lay the doubt whether any species except Japanese larch and Corsican pine on really suitable sites could be expected to flourish in the polluted atmosphere of the South Wales industrial areas. Thus the real reasons for lack of success were obscured, and only slowly was a balanced view obtained.

It is worth noting that, excluding excessive atmospheric pollution, the silvicultural difficulties encountered in Margam and other South Wales areas were met also in many other Commission forests where contributions to their solution were made by research and improved large-scale practice. This illustrates the unity of silvicultural knowledge and the necessity for forest officers keeping up to date with the progress elsewhere.

Another general point of interest in the history seems to me to be the growing confidence of local officers in their ability to grow good forests in South Wales. Naturally in the course of time the various species have demonstrated their capabilities to greater or less extent and there have been gradual improvements in technique of which ploughing is perhaps the outstanding example. Nevertheless, in difficult areas, as I minuted after my South Wales inspections of 1942, "there is little margin to spare and every mistake has to be paid for at an unusually heavy rate." A recent example is the failure of seedling planting.

In 1937, 1942 and again in 1947 I met the South Wales technical officers and discussed with them on each occasion the current state of

technical knowledge and procedure. The records of these discussions are available (that of 1937 is appended to the Margam History). It would be of great interest if Director, Wales, would now hold a similar meeting. There would then be four records at five-yearly intervals and from them a very useful account could be compiled.

R.

28th March, 1952.

## HISTORY OF MARGAM FOREST

### GENERAL DESCRIPTION OF THE FOREST

#### Situation

The forest is situated some one to five miles north-east and east of the town of Port Talbot in the County of Glamorgan. It takes its name from Margam Abbey, a Cistercian monastery founded in A.D. 1147. This abbey occupied an important position in the social and religious life of Glamorgan until the dissolution of the monasteries, after which it became the centre of a large and wealthy private estate.

The forest lies close to the north coast of the Bristol Channel in the triangle between the towns of Maesteg and Port Talbot and the village of Pyle.

All the land held by the Forestry Commission is leasehold and, although leased from a number of owners, was, at one time, the property of the Talbot family of Margam Abbey.

#### Area and Utilisation

Ten separate leases account for the present total of 5636.729 acres. Details are given in Table I in Appendix III.

The forest is supervised at present by a Grade I forester, assisted by a local foreman and, when staff is available, by an ex-school foreman or ganger.

It is hoped, eventually, that the plantations should extend to about 4,850 acres. The utilisation of the land at 30th September, 1951, is set out in the table overleaf:

TABLE II

(a)	<u>PLANTATIONS</u>		
	Acquired	Nil	
	Formed by Commission	2355	2355 acres
(b)	<u>LAND TO BE PLANTED</u>		
	For Afforestation:		
	In hand	171	
	Tenanted	1596	
	For Reafforestation:		
	In hand	569	
	Tenanted	34	2370 acres
(c)	<u>NURSERIES</u>		Nil
(d)	<u>AGRICULTURE</u>		
	Number of Tenancies - 12	Area 798	798 acres
(e)	<u>F.W.H.</u>		
	Number of Holdings - 5	Area 101	101 acres
(f)	<u>UNPLANTABLE LAND IN HAND</u>		Nil
(g)	<u>OTHER LAND</u>		13 acres
		Total	5637 acres

The original acquisitions of Margam were managed as sheepruns except for Graig Emroch where there was some scrub and a few European larch of which one or two still survive. There were occasional good oak in Cwm-wernderi and Cwmgoblyn: some of these were 70 ft. in height and were bought at valuation by the Forestry Commission and used for fencing material. The previously existing woodland, of which these oaks were the vestiges, had been cut for the Cwmafon Copper Works, and the timber was delivered there by mule train. The Margam Estate also obtained a lot of fencing material every year from these valleys.

Most of the farms carried three or four sheep per acre, but this was heavy over-stocking. The average rent was 1/- per acre, but this was low for the district because of the losses of stock due to the fumes from the Cwmafon Copper Works, which poisoned the vegetation. This Works eventually closed about 1912.

The price of wool at this time was 3d - 4d per lb. and the price obtained from one year's wool clip was usually sufficient to pay three



years' rent of the farm. Farmers suffered heavy losses from dogs which worried the sheep, and it was not uncommon for up to a dozen sheep to be killed by dogs and left in the streams which feed the Port Talbot Reservoirs. The owners of the sheep were expected to bury them.

Farmers usually tried to burn their rough grazings every other year before the middle of March, if possible. They did, however, suffer considerably from mountain fires which were larger and far more frequent than today.

The area was overrun with rabbits, at any rate on the lower portions, and there were still quite a few pheasants, partridges and hares about. The Margum Estate gamekeepers were still spending quite a lot of time on this part of the Estate. Poaching was rife, however, and the stock of game did not long survive the change of tenancy.

When planting started, human trespass immediately became a problem. The local population had had the free run of the area for a considerable period of time, and they believed they had an absolute right to go anywhere.

The new area acquired at the end of 1949 was, like the original, largely sheep farms, mostly tenanted at the time of acquisition. It does include the woodland areas of Graig Fawr, Cwm Maelwg and Cwm Kenfig which were felled during the 1939/45 war. When this felling was in progress, two of the Commission's officers were sent by the Research Branch to record silvicultural data, and the results of their work are set out in Appendix IV.

Mynydd Margam, which is included in this acquisition, is noted for a remarkable number of burial mounds and camps of various dates, from the early Iron Age to Roman times. At present, the Ministry of Works are anxious that large areas should be left unplanted to facilitate future excavation and, as a temporary arrangement, planting this area is deferred until 1956 or thereabouts.

Disturbance of existing farm tenancies is a gradual process. As the outlying sheep runs are required for planting, negotiations are started with the Ministry of Agriculture's Land Commissioner to determine the area of inlying land and sheep run which must be left in agriculture to retain the farm as an economic unit. When agreement is reached and an amended tenancy arranged, it is customary to transfer the agricultural ground to Ministry of Agriculture and Fisheries for management.

### Public Water Supplies

Much of the older part of the forest constitutes the water catchment area of the Borough of Port Talbot and that part to the east of the British Trackway feeds into the supplies of the Mid-Glamorgan Water Board.

Until the summer of 1950, forest operations could be carried out unhindered, as none of our work appeared to effect the purity of the water supplies. Then, however, a large increase in the planting programme with consequent ploughing, and with roadmaking near the reservoir, combined with a particularly wet summer caused a lot of clay to be washed down the streams, into the Port Talbot Reservoirs. This was aggravated by a cloud-burst which caused a serious wash-out in a hillside in Compartment 27 above one of the collecting streams. The Port Talbot Council has no filtration plant, and as a result the consumers were supplied with very dirty water. The Council reacted strongly, and measures have had to be taken in consultation with the Borough Engineer which, from time to time, virtually suspend Forestry Commission activities in the catchment area. There is no permanent remedy to this hindrance and inconvenience until the Borough augments its sources of supply, which it is now seeking to do, or instals an adequate filtration plant. Finding the permanent remedy will take at least another year and possibly two, but meantime the interests of the townspeople demand our co-operation in keeping the water supply unpolluted.

### Physiography

Elevation varies from 50 ft. to 1100 ft. above sea level. As a result of glaciation, steep slopes run up to gently rounded or flat hilltops. The most prominent feature is Mynydd Margam, a plateau of between 900 ft. and 1100 ft. above sea level exposed to the sweep of the South-westerly gales from the Channel.

As is natural on such a large area, all aspects are represented but south-west predominates. Much of the hinterland is protected by the slopes, where exposure is not so severe as to prevent the establishment of reasonably successful plantations, but at higher elevations exposure is severe.

Towards the west, Cwm Dyffryn with its river and railway running nearly north to south separates the Emroch block from the main block to the east.

## Geology and Soils

Practically the whole of the forest lies on the Pennant sandstone, though small areas, notably Compartments 52, 61, part 62, part 69, part 70 and 71 in the north and Graig Fawr Compartments 100-103 in the south, lie on the sandstone of the lower coal series. In the north the boundary between the two strata is the well known Moel-gilau fault. This is the only fault of any importance and, apart from about half a dozen small ones, the area is free from faulting, an unusual state of affairs in Glamorgan. Coal outcrops are also rare, but the Rock Fawr and Rock Fach seams outcrop in the south-west and south of the forest. Strata dip in all directions, but mainly to the north and west: the angle of dip varies from 10° to 40°. Extensive coal mining has taken place under most of the area, and the consequent subsidences, together with the naturally high degree of cleavage of the strata, tends towards very rapid drainage of surface water.

The soils derived from these coal measures vary from a sandy loam to a fairly heavy clay loam and they are usually deep. On the higher tops and plateaux there is peat, usually of no great depth, overlying a wet clay. Mineral soils at these elevations are severely leached and over large areas, especially on Mynydd Margam, there is a well developed pan. Here and there, traces of glacial drift occur. Undoubtedly the most favourable soil conditions occur on the old woodland sites in the south, i.e. Graig Fawr, Cwm Maelwg and especially Cwm Kenfig, where the soil is a light sandy loam, and probably the best forest soil we have yet had to deal with in Glamorgan. Generally, however, the soils are less fertile than in other parts of the country, and it is unlikely that we will ever be able to grow anything better than Quality Class II plantations.

## Vegetation

This is typical of the South Wales "mountain". The most widespread species is undoubtedly Molinia on the wetter flats, but on drier sites this changes to Aira or sheep fescue with, on the more open soils, a heavy mixture of bracken. On the harder and drier sites Vaccinium occurs profusely in association with either Aira or Nardus, but heather is comparatively rare. On old woodland areas there is an impoverished woodland flora characterised chiefly by foxglove with hyacinth and grasses and Juncus is locally abundant.

As "bog" conditions are practically absent, there is very little Scirpus or cotton grass.

### Meteorology

Rainfall is normally between 60 in. and 70 in. per annum, evenly distributed throughout the year; it is probably rather more on the higher parts of the forest. Snow is not a serious risk: it seldom occurs and when it does it does not lie for long.

Some frost damage has occurred in the lower lying valleys and hollows, but much of this could have been avoided by proper selection of species. The furthest point of the forest is no more than 6 miles from the sea. In general, the climate can be described as mild maritime, but much of the area is exposed to the prevailing south-west wind, and this is the most important climatic factor affecting the forest.

### Risks

Fire is undoubtedly the most important and Margam has one of the worst fire histories of any forest in the country. On 9th March, 1929, 697 acres were destroyed by a fire which was started by the tenant of a Forest Worker's Holding burning herbage in his fields. Two days later, a second fire destroyed an additional 59 acres. Again on 9th February, 1936, some 510 acres were burned including some which had been replanted after the 1929 fire. On 15th April, 1942, 54 acres, much of it in the pole stage, were burned on Mynydd Emroch when an aeroplane, after colliding with the overhead power-line, crashed into the plantations. The most recent large fire was on the 9th July, 1949, when 48 acres in Compartments 47 and 48 were destroyed. These, in brief, have been the principal fires, but there have also been many smaller ones and, up to the present, some 1,500 acres have had to be replanted to replace plantations destroyed by fire.

During recent years the fire history has improved in step with a better appreciation by the local inhabitants of the value of the plantations, ~~and~~ the disastrous effects of forest fires. There has also been a steady improvement in our equipment and technique, but even so the fire risk remains a serious problem on such a large area devoid of natural fire breaks and exposed to continual trespass by town dwellers. Constant watchfulness is essential, together with rapid and well organised attacks on every outbreak of fire likely to menace the safety of the plantations.

At present the railway is the main source of trouble.

Rabbits were numerous at first, but with the removal of the Margam Estate keepers they were quickly exterminated. They are, however, still present in the woodland areas of the latest acquisition and on Hafod Farm.

Fallow deer are present in some numbers in the old woodland areas in the south of the forest. These have done only a small amount of damage in the older plantations, but are proving more destructive in the newly formed plantations in the south. The deer are "escapes" from Margam Park, now breeding in the forest. Their numbers have lately been greatly reduced by control measures initiated in co-operation with the present owner of Margam Castle and the Agricultural Executive Committee.

Sheep are ever present and are not infrequently turned into the plantations intentionally. Regular patrolling and periodic driving are necessary.

Grey squirrels have not yet reached the forest, though two have lately been killed close at hand. It is therefore likely that others will appear before long.

Voles were troublesome in the winter of 1937/38 when they attacked the bark under the snow. The P.34 Japanese larch in Compartment 58 suffered severely. We have not been troubled by them since.

All the commoner forest insects have appeared from time to time, and the following is a brief list of their more important attacks:-

Hylobius abietis appeared in large numbers in 1926, especially in Compartments 31 and 32.

Evetria buoliana did a lot of damage to Scots pine in the years 1937-43 especially in Compartments 8, 9 and 14, but there has been little sign of it since.

Myelophilus piniperda has been firmly established in the older pine crops, especially Compartments 1 - 3, for at least 10 years.

Ips sexdentatus appeared in 1947 mainly on Corsican pine and Scots pine in Compartments 49 - 51, but only a small amount of damage was done, and it has never spread. Large numbers of these insects were drowned in the wet autumns and winters of 1947 and 1948. In heavy rain, water was found to be streaming down between the bark and the wood of heavily attacked trees, and many dead adults, newly hatched and otherwise, were found.

Ants have been causing trouble for years in small isolated sites notably in Compartments 30 and 33, and these still persist.

Neomyzaphis abietina has severely attacked Sitka spruce plantations during the past 6 years. While it is most severe in plantations which are not growing with full vigour, it attacks vigorous trees also, and there seems to be no limit to its distribution.

No chapter on "Risks" would be complete without a reference to "smoke damage". In the earlier years when our silvicultural knowledge and technique were less advanced than at present, large areas of our plantations immediately went into check and remained there. This was almost always due to wrong selection of species (e.g. large areas of European larch and Douglas fir) or to faulty technique (e.g. direct planting of spruces in moorland conditions). but this was not understood at the time. This state of affairs was quickly ascribed to "smoke" or "fume" damage, but we now know that this was erroneous. It is true that, growing as they are in the middle of a busy industrial area, the plantations receive a certain deposition of soot, but this is comparatively slight and does not appear to have any marked effect on tree growth.

South Wales perhaps differs from other industrial areas in that both the industries and the population are often found isolated by rural surroundings, and the smoke nuisance is probably more widespread than elsewhere. In any case the main industry of the valleys, coal mining, does not cause much atmospheric pollution, and away from the influence of urban Steel and Copper Works the sole effect seems to be depositions of soot on the tree foliage.

#### Roads

Margam has always been a very inaccessible forest and a lorry could only enter it when conditions were favourable by two or three rough tracks. This has been a very great disadvantage, and if we had only had a reasonable stretch of usable road it is very probable that some of the fires would have been more easily controlled, and the forest would certainly have been easier to work. In the late 1930's there was a proposal to build a road under the Ministry of Labour scheme for the relief of unemployment, but nothing came of this.

Thinning began in 1942, and it immediately became necessary to construct rough roads to get the produce away. These were made as required by the forest staff and, although they only cost about £2 per chain on the average, they stood up to surprisingly heavy traffic. In this way, quite large areas of plantation were made accessible to wheeled traffic, but progress was necessarily slow until the Roads Branch took over in the summer of 1948. Since that date about 7 miles of road have been constructed or improved, and this has greatly eased the problems of extraction, administration and fire protection. A further 5 miles or so are still required before the older portion of the forest can be adequately served, and are now under construction.

### Labour

From the formation of the forest up to the outbreak of the 1939/45 war, unemployment was fairly widespread in the industrial area of South Wales. It was therefore quite a simple matter to recruit the small amount of labour required from such centres as Port Talbot and Maesteg, which are only a few miles away. Most of this labour, however, was of the industrial type which was not used to, and did not take kindly to, rural working conditions. It was customary, too, to take on comparatively large numbers of men in the planting season, and to dismiss most of them when planting was finished, keeping only a skeleton staff to do the weeding in the summer. This practice gave the Forestry Commission a very bad name locally as an employer, a name which it has not yet entirely lived down.

Because of this practice, the outbreak of war caught us unprepared, our sources of casual labour dried up almost overnight, and we were immediately faced with a labour shortage which, naturally enough, was never overcome until about 1946.

During this time there were comparatively few labour disputes, and there are still four men working on the forest who started working for us about the same time as the forest was started: one of these is now a foreman and another is a ganger. There is no other similar case in the South Wales industrial area. In addition, it is known that there are three other original members of the Margam labour force still working for the Commission in other parts of the country.

During the war attempts were made to make good the labour shortage by employing conscientious objectors and members of the Women's Land Army. These were not very successful, but some local girls were eventually recruited who worked very well, and who were a valuable addition to the labour strength. They were particularly good at such jobs as brashing with the billhook and weeding, at least as good as men, if not better and certainly cheaper.

After the end of the war, we were quickly able to build up our labour force to the required strength, but it soon became obvious that the quality was poor and that most of the men had no interest in the work at all. Due to the Government's policy of bringing more industries to South Wales, a severe shortage of labour has developed, and as such projects as the Abbey Steel Works at Port Talbot are able to offer very much higher wages than the Forestry Commission it has become very difficult to maintain a staff sufficient to cope with a rapidly growing volume of work. As there is such keen competition for labour, it follows that our turnover is very considerable: in fact, to maintain our present staff of about 50 we have, at one time or another, employed 230 men exclusive of temporary labour.

The conditions of service of forest labour have greatly improved since the war and we are now able to transport men to most of the remoter parts of the forest, thus virtually eliminating the bugbear of "walking time", which was so unsatisfactory to both sides, and caused considerable discontent and trouble with the Trade Unions at Margam until a few years ago.

## SILVICULTURE

### Preparation of Ground

Although an appreciable area of the original acquisition had been woodland until about 1900, when the last of it was felled, the resulting coppice growth was killed by intensive sheep grazing. In the early years, therefore, there was only bare land to deal with and coppice presented no problem.

Some 700 acres of old woodland were acquired in 1949, most of which had been cut over during the war. Here again, the ground was left fairly clear and regrowth had been checked by grazing. The obvious treatment over most of the area is to clear the remaining scrub before replanting and no silvicultural problems arise.

*much of it was coniferous plantations*



Turfing, as a method of preparation of ground, combined with surface draining started in 1927, and was confined to the wetter places which previously had all been direct planted. This is said to have been done at a piece work rate of 2/6d per chain, and although this is probably higher than was being paid elsewhere at this time, it should be remembered that the local labour was quite unused to handling hill draining tools. In fact, this difficulty persists to the present day.

Fencing in the early days was mainly of the standard sheep and stock-proof variety, as it was obvious that the rabbit population was rapidly being brought under control. In those days, the labour cost of erection was about 6/- per chain, while today it is about 20/- per chain. Posts and stakes were largely obtained from the old oak remaining from the former woodland. Now that operations are extending to the woodlands on the south side of Mynydd Margam, it is becoming necessary to fence against rabbits for the first time.

#### Choice of Species

In this connection, reference should be made to Appendix V which comprises the minutes of a meeting held at Cardiff in July, 1937. The decisions taken at this meeting governed the selection of species during the seasons F.Y.38 - 42 inclusive, a period during which a large area was planted.

Next to fires, it is fair to say that wrong choice of species has caused the greatest trouble at Margam. Indeed, there is little doubt that fires have been a blessing in disguise to the extent that they have given the opportunity to repair earlier mistakes.

#### Pines

The pines, Scots pine and Corsican pine, have usually been correctly sited, but the evidence indicates that these species must have been in short supply in the early years, as exactly similar sites have been contemporaneously planted with unsuitable species such as Norway spruce and Sitka spruce.

Both pines have done reasonably well when suitably sited with the balance slightly in favour of Corsican pine. Wherever Scots pine has been exposed to the blast the results have been poor but improving rapidly with shelter.

### European larch

European larch was planted on quite a large scale in most years up to and including 1929, but for one reason or another was generally unsuccessful. After 1929 no further planting was done, and by 1939 most of the European larch had been "reconditioned" by interplanting with Norway spruce or, latterly, Japanese larch and these plantations are now reaching the thinning stage. There are now only three small areas of European larch in the forest, and of these only one, about 2 acres P.29 in Compartment 11, shows any promise at all. These European larch plantations seem to have been planted on quite suitable sites, and there is ample evidence that fine European larch was growing on similar sites in Glamorgan prior to 1914. They are relatively free from both canker and die-back, and it is therefore difficult to account for their failure. The following reasons are tentatively given :-

1. Unsuitable seed provenance
2. Too low or variable a water table due to underground mining.
3. Insufficient weeding in early stages.

### Japanese larch

Japanese larch has been planted since 1921, but at first only on a small scale as stocks were low. It has proved itself to be the fastest growing species planted at Margam, and it is now being extensively planted both for this reason and because of its use in fire protection. In the past, the tendency has been to confine Japanese larch to bracken sites in comparative shelter, but the current practice is to extend its use to the harder mineral sites so long as they are not too dry and to take it higher up in to the wind. Though development is slower under these conditions, it still covers the ground more quickly than any other species.

### Douglas fir

Douglas fir was planted in the early years up to 1926, but like European larch it proved something of a failure. Though it was sometimes planted on unsuitable sites, this was not always the case, and much of the failure may be due to planting the mountain rather than the coastal variety. All planting of this species was stopped for some years, but was started again on a small scale in F.Y.51.

## Spruces

In the case of the spruces, the early technique was to plant Norway spruce on the high ground and Sitka spruce in the valleys. The Norway spruce would probably have developed, though slowly, but unfortunately it has mostly been burned and the older plantations are left with the Sitka spruce in the valley bottoms which escaped the fires, but which has been severely frosted time after time, and is heavily attacked by Neomyzaphis year after year. There was also a marked tendency in the early 1930's to plant the spruces on very dry banks where pines or Japanese larch would have been a better choice and the assumption is that this was due to a shortage of these species. However that may be, the spruces, which have been heavily beaten up with pine, have grown very slowly indeed on these sites. In the 1930's too it was realised that Sitka spruce should be planted at high elevations rather than Norway spruce and the original practice was quickly altered. Because of its faster growth in the first two or three years, it became the practice to plant Sitka spruce on all sites except actual frost holes in preference to Norway spruce which was almost ousted from the planting programme. The current tendency, however, is to make increasing use of Norway spruce on suitable sites after ploughing. On the high elevations, sites with a tendency to pan or hard mineral soil, the practice today is to plant on the plough ridge a 2/3 row mixture of Scots pine and Sitka spruce rather than pure Sitka spruce, which is preferred on ploughed Molinia peat land.

The above mentioned are the principal, to all intents and purposes the only, species which have been planted. A certain pessimism about the possibilities of Margam Forest seems to have kept the earlier planting within strictly utilitarian limits, while shortage of supplies in the less usual species has been the limiting factor in more recent years. In the very early years, some beech was planted to make fire belts and this has grown quite well. Unfortunately, no further planting of this species was done until F.Y. 50 when planting started in the newly acquired old woodlands. Some sweet chestnut was also planted in blocks (now up to 30 ft. high) as a fire belt and this species would have done well had it not been for the damage caused by local boys habitually breaking off the branches to obtain the nuts. Some birch and alder have been planted at a high elevation to make fire breaks dividing large blocks of spruce, but these have grown badly and afforded little or no protection.

There is some evidence, however, that the increasing shelter provided by the adjacent conifer crops may eventually help them to establish themselves.

### Planting

(a) The spacing used has been  $4\frac{1}{2}$  ft. x  $4\frac{1}{2}$  ft. for all species except Japanese larch which was planted at 5 ft. x 5 ft. and possibly Douglas fir which may have been planted at 6 ft. x 6 ft. but it is now difficult to say. In the latter part of the war a spacing of 5 ft. x 5 ft. was adopted for Sitka spruce in order to save plants, but we quickly returned to 4 ft. 6 in. at high elevations at any rate. The present spacing distance on all ploughed land is 5 ft. each way, except for pines when it is 5 ft. between the rows and 4 ft. in the rows.

(b) All types and sizes of plants seem to have been used at one time or another, but until F.Y. 50 and 51 the use of seedlings was avoided with the exception of 2+0 spruce turf planted in Molina/peat in P.32. In F.Y. 50 and 51 shortage of stocks caused the planting of seedlings with many failures from the use of 1+0 Japanese larch and 2+0 Scots pine and beech. As poor results with seedlings seem to have been fairly general, it is reasonable to suppose some part at least of the fault lay in the quality of the seedlings.

Since the establishment of Tair Onen nursery in 1936, the bulk of the plants used has come from there. Some consignments have come from most of the other South Wales nurseries at some time or other, mainly Pembrey, Brechfa, and Fair Oak (Tintern Forest). Only very small lots have come from outside the conservancy. Prior to 1936 plants came principally from Fair Oak, Pembrey and the Somerset and Devon nurseries of the old Division 3.

(c) In the early years all planting was done by screefing and notching with Schlich spade or mattock at a cost of 1/9d to 2/1d per 100. From about 1931 the Schlich spade was abandoned in favour of the Mansfield spade with its particular style of notch planting. A small amount of pit planting was done in which case the pit was opened in November and the planting done in the following April. The only surviving example of this is thought to be some P.26 Pinus contorta in Compartment 51 - indeed a curious species to pit plant!

Furrow planting started in a small way in 1926 using Corsican pine and Norway spruce and the plants were put in the bottom of the furrow. The Corsican pine were drowned out, but the Norway spruce survived. In 1927 the cost of mound planting was 9d per 100: today's price would be 2/6d. Today the bulk of the planting is done on ploughed furrows and notching is confined to steep banks, and turf planting to the small wet patches into which the plough cannot be taken for one reason or another.

(d) As in most forests the rate of planting varied considerably from year to year. The whole area then acquired had been planted by 1929, but in the spring of that year two disastrous fires occurred in which we lost 756 acres, and this loss had not been made good by the time of the next big fire in 1936, the replanting of which continued until 1941. The following are the recorded figures:-

P.21	156	acres	P.22	150	acres
P.23	201	"	P.24	170	"
P.25	242	"	P.26	208	"
P.27	210	"	P.28	78	"
P.29	30	" (completion)	P.30	260	"
P.31	180	"	P.32	155	"
P.33	129	"	P.34	92	"
P.35	54	"	P.36	8	"
P.37	65	"	P.38	53	"
P.39	160	"	P.40	131	"
P.41	119	"	P.42	-	"
P.43	16	"	P.44	22	"
P.45	-	"	P.46	22	"
P.47	-	"	P.48	1	"
P.49	116	"	P.50	388	"
P.51	413	"			

(e) The application of basic slag to spruces, and possibly pines, was carried out during the 1930's, but no records of areas or results now exist. No manurial treatment was given any plantations from the advent of deep ploughing as regular practice.

(f) Apart from the earliest plantations which, by all accounts, were fairly poor before being burned, the species that have failed to become established are European larch and, to a less extent, Douglas fir. Other species when slow in becoming established can generally be said to have been badly sited, e.g. Sitka spruce when planted below the frost level. The greatest success has been with Japanese larch which has always established itself rapidly except on the more exposed sites. Corsican pine, though slower initially, has been almost equally successful. The P.39 - 41 Sitka spruce planted on close ploughed high elevation land are, up to the time of writing, extremely vigorous and have checked for only a short time. Next in order comes Scots pine which has been rather slower to establish itself largely on account of the severe outbreak of Evetria buoliana in the years preceding the last war. The slowest of all plantations to become established have been the direct planted Scots pine and Norway spruce mixed plantations, generally at high elevations, but these are now coming away quite well.

Considering its history, the general impression now presented by the older plantations is very encouraging, and if the earlier lessons have been fully learned augurs well for the future.

### Ploughing

Ploughing was started experimentally in 1926 using an agricultural plough drawn by three horses. This plough was eventually fitted with a homemade share, made from an old chaff cutter knife, riveted on to the existing share. Quite substantial areas were dealt with in this way, but most of it has been burned at least once and all traces have been lost in the subsequent reploughing with tractors. The only remaining example is in <sup>new 56 55</sup> Compartment 25 and 26, where P.31 Sitka spruce on Vaccinium/Aira on a dry site is doing quite well. This ploughing was done by local farmers, and both wet and dry sites were tackled so long as they were not too steep. The earliest planting of spruces in the furrows gave little better effect than screef planting, but planting on the ridges was quickly shown to reduce the check period.

Tractor ploughing started in 1933, but here again the earlier work has all been destroyed by reploughing after fires. This first tractor ploughing was only three to four inches deep, and it did not disturb the underlying pan and, although planting was on the ridges, spruces were still going into check.

It was not until 1939 that ploughing, as we know it today, really got under way using a Ransome's solotrac plough and a Caterpillar tractor. Large areas of the comparatively flat mountain top were ploughed in this way in 1939-41 to a depth of 6 in. - 8 in. Here the Sitka spruce had a much shorter check period and are still in vigorous growth.

Ploughing has always been done by a single furrow plough at 4 ft. 6 in. to 5 ft. spacing: no "complete" ploughing has ever been tried, except in F.Y. 51 when an area of about 20 acres of moorland (Compartment 87) which had already been ploughed by the Agricultural Executive Committee was resumed. This was clear of vegetation and was direct planted with Sitka spruce.

Between 1942 and 1948 inclusive, no ploughing was done, but in 1949 the new acquisitions brought in additional large areas of ploughable land, and ploughing started again. In the meantime, ploughs had undergone considerable development and we now had the R.L.R. which could normally plough to a depth of 10 in. and was therefore admirable for the highly podsolised soil on Margam mountain, where it broke the pan along the whole length of the furrow. This plough could only work at a maximum speed of 5 acres per day under the easiest conditions as on Margam mountain, and under more difficult conditions the speed dropped to about 1 acre per day, while breakages were frequent partly due to a tendency on the part of operators to plough too deeply. In 1951 a double mould board Cuthbertson plough was used, with which we were able to attain a speed of 10 acres and more per day. This plough cuts a furrow every 10 ft. instead of every 5 ft. but unless properly set has a distinct tendency to ride along the top of the pan. Some of the earlier work failed to completely break the pan, but this difficulty was largely overcome by ploughing along the bottom of the furrows with an agricultural plough. Greater experience on the part of the operators, coupled with a few minor modifications to the equipment, has given more satisfactory results and the double mould board Cuthbertson is in general use. The Cuthbertson ploughs often working in teams of two do the bulk of the ploughing, and all the long work, leaving the short work and odd corners to smaller and easily manoeuvrable single furrow ploughs.

### Beating up

Up to F.Y. 37 failures in the original plantings were heavy and beating up was consequently a very considerable item. The main reasons for the failures were wrong choice of species and lack of drainage and cultivation. Frequently, too, the wrong species was chosen for beating up, perhaps on account of a shortage of a more suitable species, and this in turn has had to be replaced. Thus we have P. 23 Douglas fir on hard, dry Aira/Vaccinium ground beaten up with Sitka spruce in 1934 and 1935: P. 26 Scots pine and Corsican pine on similar ground beaten up with Norway spruce most of which have now been cut for Christmas trees, and European larch beaten up with Norway spruce and finally almost replanted with Japanese larch in 1938 - 1940 which is now in the brashing stage. The condition of the plantations today shows that many more plants than necessary were used and much useless work done as, for example, 9 years old Japanese larch beaten up with small Sitka spruce which today, eighteen years afterwards, are still struggling to break through the canopy. Elsewhere is to be seen beech which appears to have been cut back to avoid suppressing other beat-up plants of Japanese larch put in at a later date.

By 1939 the introduction of deep ploughing and a better understanding of the locality factors, coupled perhaps with a better plant supply, had begun to reduce beating up to more reasonable proportions, and by 1940 the worst of the European larch had all been "reconditioned". Thereafter, the amount of work under this head became almost nominal until the recent unfortunate experiences with seedlings.

Apart from the examples of wrong choice of species, beating up appears to have been generally successful, at any rate there are no cases of unsuccessful plantations due to bad stocking. The only example of interplanting is the reconditioning of failed European larch plantations interplanted with Japanese larch in F.Y. 38 - 40: these have been completely successful and are now being brashed. Some are about ready for thinning and if any <sup>thrifty</sup> European larch are found these will be favoured.

The screefed or turf planted spruces manured with basic slag can no longer be identified, even in the compartments where its use was recommended by inspecting officers.

Normally, beating up has been done in the first or second year following planting though sometimes, when the species has been changed, a much longer



C 26  
(new 55)  
period has elapsed. The P.23 Douglas fir is an example of this, and here an operation then known throughout South Wales as "delayed beating up" was carried out in 1933-1935. This amounted to the filling of gaps with large plants, usually Sitka spruce, no beating up having been done for several years previously.

### Weeding

In the early years, this operation did not receive the attention it merited, mainly because of an almost annual cut in the Estimates. Large areas were insufficiently weeded and undoubtedly many plants were smothered. This is particularly the case with the European larch plantations, but it also applies to the spruces. It used to be held that so long as the apical bud of the young spruce was showing above the Molinia, weeding was unnecessary, and it follows that large areas were unduly checked because the plants got insufficient light in the growing season. More attention seems to have been paid to the pines than to any other species. This lack of weeding is referred to constantly in old compartment notes and is reflected in the piece work rates which were being paid around 1930, viz:-

Weeding larch (mainly bracken)	- 6/- per acre
Other species	- 7/- " "

Weed species are mainly bracken, Molinia, Aira flexuosa, Vaccinium etc.- the normal vegetation of the South Wales Heathlands. There is very little heather, but some bramble and gorse does occur.

Ploughed heathland normally requires no weeding in the first year, and we now have quite large areas of Sitka spruce on furrows which have never been weeded at all. This is due to the smothering effect of the furrow in the first year, and to the advantage in height that it gives to the plant which, if it does not check, may be above the weed growth by the second season.

### Mixtures

It has not been the practice to plant species in mixture, though in F.Y. 30 and 31 small areas on dry mineral sites were planted with mixtures of Scots pine and Norway spruce in alternate rows. The pine has generally outgrown the spruce, and is very rough but the spruce, though in part suppressed, are coming away in places and will be favoured in the thinnings.

There is little doubt that the Norway spruce are in a better condition now than they would have been had they been planted pure. Mixing by large scale groups has been practised for some years in that a change in site factors is met by a change of species.

In 1944, at the Chairman's instigation, the practice of mixing pines with Sitka spruce on dry mineral sites at high elevation was started and has become almost standard practice today. Single row mixing has been abandoned in favour of 2 rows of Scots pine to 3 of Sitka spruce, or conversely, depending on which species is likely to succeed best.

#### Rates of Growth

The following table gives a note of the growth of some of the more interesting plantations, many of which are specifically mentioned elsewhere.

Compt. Year 1969	Species	P. Year	Age	Vegetation and Soil	a. Altitude b. Aspect c. Slope d. Exposure	Mean height of Dominants ft.	Mean Annual Ht. Increment ft.	Current Annual Ht. Increment during last 5 years ft.	Remarks
56 (NW) 12 New 1969	J. L.	23	28	Bracken: grass, sandy clay with stones.	a. 700' b. North c. Steep d. Sheltered	50	1.8	2.6	Present Vol./acre = 2500 cu. ft.
30 49	S. P.	26	25	Aira/Vacc. Sandy clay with stones.	a. 800' b. North c. Steep d. Exposed	25	1	1	Very thin crop with only 1 year's needles.
30 49	C. P.	26	25	Aira/Vacc. Sandy clay with stones.	a. 800 - 900' b. North c. Steep d. Exposed	27	1.1	1.4	
29 52	S. S.	26	25	Molinia. Leached sandy clay with stones.	a. 600 - 800' b. North c. Moderate d. Moderate	17	.68	1	Has been continually frosted and attacked by <u>Neomyzaphis</u> , but now beginning to grow.
56 (S) 25	S. S.	31	20	Aira/Vacc. Leached sandy loam with stones.	a. 800' b. North c. Moderate d. Exposed	25	1.25	2	Originally horse ploughed, but extensively beaten up on mounds. Now growing vigorously.
56 (NE) 24	S. P./N. S.	31	20	Aira/Vacc. Sandy loam with stones.	a. 700 - 800' b. North c. Steep d. Fairly sheltered	S. P. 28 N. S. 23	1.4 1.15	1.8 1.8	Very irregular, each species dominant in patches, requires thinning now.
50 (part) 34	S. S.	34	17	Molinia. 6" peat on leached sandy clay. No iron pan, but drainage impeded	a. 900' b. Flat c. Flat d. Exposed	18	1	1.6	One of the earliest tractor ploughed plantations. Has been checked for a long time but now beginning to grow vigorously.
41 (E) 45/46 43 (N)	S. S.	39	12	Molinia. 6" peat on podsolised sandy clay. Drainage adequate.	a. 900 - 1000' b. North c. Gentle d. Exposed	15	1.25	1.41	Earliest really deep ploughing with Solotrac. Reploughed and replanted after fire.
44 (N) 41-44 39 (NE) 42 40 (E) 43/44	S. S.	41	10	Molinia. 6" peat on podsolised sandy clay. Drainage adequate.	a. 900 - 1000' b. South c. Moderate d. Very exposed	8	.8	.92	Reploughed with Solotrac after fire. Never weeded or beaten up.
46 56	J. L.	40	11	Bracken: grass, deep sandy loam with stones.	a. 700' b. N.E. c. Moderate d. Sheltered	33	3	3	Originally P. 28 E.L. Beaten up with Norway spruce and beech. Reconditioned F.Y. 40 and now is ready for 1st thinning.

### Past Treatment of Established Plantations

As the bulk of the established plantations were planted on open ground or heavily grazed coppice, it follows that cleaning has not been a major operation. It is therefore all the more unfortunate that the little that was necessary (in the east of Compartments 1 - 3) should have been entirely neglected due to financial stringency.

Brashing commenced about F.Y. 38 and up to F.Y. 45 was mainly done with the billhook when the change over to saws was made, but billhooks are still used by the more skilled workers, except in the spruces where saws are invariably used. It is the regular practice to brash plantations completely, partly as a precaution against fire and for the same reason the "brashings" are laid in alternate rows, leaving every other row clear. Any tree which will not be saleable and which it will not pay to brash is usually cut down and laid with the brashings in this operation. Brashing is usually done to a height of 6 ft. and generally as day work, the men being reluctant to accept piece-work rates for this operation.

Thinning commenced in 1943 in the P.23 Japanese larch (Compartments 11, 12, 24 and 29). There is no doubt that thinning should have started earlier than this. So far the crops thinned have been mainly Japanese larch, Scots pine and Corsican pine. Only a very small area of Sitka spruce (P.23 Compartment 28) has reached the thinning stage. Up to the present, it has been found necessary to thin larch plantations every 3 years and pine every 4 years, but the total area of thinning has not increased markedly each year, as such large areas of the earlier plantations have been destroyed by fire.

The following is a note of the thinning programme carried out each year :-

<u>F.Y.</u>	<u>1st Thinning</u> <u>acres</u>	<u>2nd and subsequent thinning</u> <u>acres</u>
43	38	
44	41	
45	8	
46	14	
47	1	28
48	34	-
49	22.5	15
50	19	38
51	26	21

The average volume produced from a first thinning of all species has been around 180 cu.ft. per acre, some 360 trees per acre being removed. Second thinnings gave a greater variation, and the following are typical figures:-

<u>Species</u>	<u>Poles/acre removed</u>	<u>Vol/acre removed</u>
Japanese larch	152	182
Corsican pine	266	325
Scots pine	230	235

Despite its chequered earlier history, Margam Forest is now yielding receipts from sales of produce, and these should go on slowly increasing. The value of sales has risen from £1,118 in F.Y.49 to £1,645 in F.Y.50, and £2,014 in F.Y.51. The forest's situation in relation to industrial towns and the coalfield favours a good return from sales, particularly of pitwood, as most of this form of produce can be loaded to lorries in the woods and delivered direct to colliery yards, thus saving a second handling.

#### Research

No research work has been carried out at this forest.

#### Conclusions

As has been mentioned above, the early history of Margam has been most unfortunate: large areas of plantations failed to grow satisfactorily, and if they did, they were generally burned. So much so, that in 1937 the Chairman minuted that we had been spending too much money on Margam, and had very little to show for it. As recently as 1942 he said that our experiences had been such as to make us think carefully before we acquired further land in the neighbourhood.

Despite all this, it is now obvious that with our increased knowledge of the locality factors, and of the technique of afforesting moorland, there is no reason at all why we should not successfully establish plantations over the whole area of the forest. Our silvicultural knowledge is far from complete. Recent plantations have been relatively cheaper to establish and have grown better, but there is still no real explanation of why European larch has proved such a miserable failure on apparently suitable sites, and we can only suspect the reasons for the failure of Douglas fir. Exhaustive experiments have not been carried out with the latter species at Margam Forest, but experience elsewhere in the South Wales Coalfield confirms that Douglas fir will only flourish on carefully selected sites. It is very unfortunate that the use of other species has not been more widely explored. For example, Abies nobilis might be worth extended trials.

Many parts of this forest have, in the past, grown good hardwoods, and it is the intention to increase the planting of beech and oak, particularly on the old woodland sites. The very prominent Graig Fawr facing the main Port Talbot/Cardiff main road has already been planted with beech, and should aid in reducing the criticism so frequently levelled that the Forestry Commission plants only conifers. It is a very prominent shop window, as is well known to Commissioners and others resident in the locality.

In fire protection, technique and equipment have greatly improved; the public are generally much more "fire conscious" than they were, and it should now be possible to avoid the devastating fires of former years. Constant watchfulness is as necessary as ever, but assistance from organized clubs and the general public is much more freely given and it is hoped in time to interest Youth Clubs and Ramblers' Clubs to the extent of setting up a system of Honorary Wardens and Fire Guards. The new system of forest roads, when completed, will be of incalculable value to fire protection, provided always there is no shortage of suitable vehicles to transport men and equipment to the scene of a fire, for SPEED is still the essence of the contract.

Margam Forest may have been a great disappointment in its earlier years, but today a view of the Cwm Wernderi and the adjoining slopes is heartening in the extreme. Patient - and possibly expensive - endeavour has produced some good plantations which add much to the scenic beauty and are beginning to become profitable through supplying pitwood to the nearby collieries. Margam Forest may take a very long time to produce Quality Class I stands, but its position in relation to the mines and the large industrial towns affords an excellent opportunity for it to play a profitable part in building up the beauty and the wealth of Wales.

## HISTORY OF MARGAM FOREST

### APPENDIX I

#### NOTES FROM INSPECTION REPORTS

On 30th October, 1927, the Chairman accompanied by Divisional Officer C.O. Hanson inspected the Molinia tops recently planted to Norway spruce and Sitka spruce and also the P.22 plantations around Blaencyneiron. He commented on the poor appearance of the spruces, of which Sitka spruce was the better, and referred to insufficient drainage in certain areas. Some Douglas fir seen was thought to have been affected by smoke and fumes and was described as "too delicate for the area". The P.22 plantations of Sitka spruce, Japanese larch and Scots pine were looking well, but were gappy although beaten up two or three times. On this visit, the Chairman stated: "It is possible at this stage to spend a great deal of money on Margam to no useful purpose, especially in beating up the spruces prematurely. Patience is required and, if the question of beating up a spruce area is in doubt, it is the most economical plan to wait".

*SW angle CAO  
On F.H. map,  
C 19, 20.*

The Chairman, the then Assistant Commissioner (Mr. H. A. Pritchard), Divisional Officer Hanson and District Officer Ryle visited Margam on 27th March, 1929, to investigate the circumstances of the disastrous fires which destroyed 697 acres on 8th March and 59 acres on 10th March.

On 26th August, 1931, during a visit by the Assistant Commissioner and the Divisional Officer, a careful survey was made of the older Douglas fir plantations and the decision taken to make good with Sitka spruce. All the small blanks in the planted areas were to be planted up, and all plantations put into good order.

Mr. O. J. Sangar visited Margam on 19th and 24th May, 1932, and reported on the plantations by P. years and gave a general note on the growth of the species. This report gives a comprehensive picture of the condition of the plantations at this date and is summarised below:-

The plantations formed in F.Y.21, 22 and 23 were largely burned in the fires of March, 1929, together with parts of P.24, 26, 27 and 28.

P.21 and 22 are now represented by small areas of Japanese larch, Scots pine and some Sitka spruce. The Japanese larch was heavily beaten up with Japanese larch in F.Y.23 and with Douglas fir or Sitka spruce in

F.Y.24 and subsequent years. The canopy is complete except for many small gaps apparently caused by bracken and many of these gaps contain Sitka spruce, Douglas fir or beech of various ages and sizes, but everywhere shorter than the Japanese larch. The Sitka spruce are in danger of suppression.

Scots pine have formed canopy: their height is 10 ft. on the better sites, and 7 ft. with 12 in. leaders on the poorer.

Sitka spruce on wet flushes is 7 ft. - 10 ft. in height with 18 in. leaders: stocking incomplete.

P.23 Just over 100 acres remain, of which half is Japanese larch up to 20 ft. in height.

There are some 20 acres of Douglas fir which is unsatisfactory and being replanted with Sitka spruce.

The Corsican pine planted at 600 ft. - 800 ft. is suffering from windthrow; 5 ft. high with 12 in. - 24 in. leaders.

The Scots pine is adjacent to the Corsican pine but more exposed: 4 ft. high with 15 in. leaders.

The Sitka spruce is only 50% stocked, and is 5 ft. high with 12 in. - 24 in. leaders.

P.24 on Graig Emroch in Compartments 1 - 6 :-

Douglas Fir - 3 ft. - 4 ft. high with 6 in. leaders: very poor.

Scots pine - 4 ft. - 8 ft. high with 6 in. - 15 in. leaders

European larch 4 ft. high with 6 in - 9 in. leaders but suffering from a bad attack of "bud moth".

P.25 - 20 acres Corsican pine along the crest of Graig Emroch:

suffered from sheep damage and windthrow: 8 ft. - 9 ft.

high with 24 in. leaders.

P.26 - 150 acres remain (out of 208).

About 90 acres of exposed Molinia/Aira were planted with Norway spruce in (the bottom of) ploughed furrows. These have mostly been smothered by grass, but the survivors are 12 in. - 18 in. high and growing 6 in. per year.

Corsican pine and European larch planted on a north slope (Compartments 49 - 52) are generally poor, only 3 ft. high and largely replanted or beaten up with Norway spruce.

P.27 - 210 acres - includes 100 acres of Norway spruce mostly planted in the furrows and somewhat smothered. Better in appearance is a small



area of Sitka spruce 2 ft. high with 9 in. - 12 in. leaders. Most of the remainder was planted with European larch on sheltered Calluna/bracken or old agricultural land (Compartments 54 - 56): now 3 ft. - 6 ft. high with 6/18 in. leaders, but the smaller plants are of poor form.

P.28 - 78 acres - Sitka spruce and European larch around Blaencwmgerwyn. Sitka spruce partly turfed and partly notched: those on turfs are now 3 ft. with 12 in. leaders while the notch planted trees are only 18 in. high with 6 in. leaders.

P.29 - 30 acres - mainly European larch 18 in. to 24 in. high.

P.30 and 31 Some 440 acres burned in the fires of 1929 and replanted mostly to Sitka spruce with some Scots pine and small areas of Japanese larch, Corsican pine and Norway spruce. All species are satisfactory to date, but most of the spruces were notch planted and are not yet out of check.

#### General Notes on the Growth of Species

Scots pine. Height growth is fairly satisfactory, 10 ft. in 10 years on the better sites: is being heavily attacked by Chermes and Lophodermium.

Corsican pine. Slightly taller than Scots pine, is suffering from windthrow on most sites.

European larch. Disappointing throughout: few trees more than 6 ft. high. May be due to smoke damage, poor quality of planting stock, bud moth and damage from bracken and bramble.

Japanese larch. Almost wholly satisfactory. A P.21 plantation in full exposure is now 12 ft. high with 18 in. leaders and only the biggest trees are showing any sign of exposure.

Douglas fir. Generally thoroughly unsatisfactory: average height at 8 years is only 3 ft. - 4 ft. and with little sign of improvement. The

Frazer River variety appears more healthy than the Oregon.

*Green Coastal would doubtless have been better still*  
Norway spruce. Seems to check for at least 5 years.

Sitka spruce. Up to 10 years old the height growth of this species is little better than that of Scots pine or Corsican pine but the needles are now increasing in length. On exposed peat areas growth is better than Norway spruce and the check period shorter.

Sweet chestnut. A P.24 fire belt on Graig Emroch is now 6 ft. high.

Beech. Satisfactory - 8 ft. high after 9 years growth.

### Future Proposals

Douglas fir plantations should continue to be beaten up or replanted with Sitka spruce.

Molinia flats should be ploughed and spruces planted on the furrows.

The Assistant Commissioner, Divisional Officer F. Scott and District Officer G. B. Ryle, accompanied by two representatives of the Ministry of Labour, visited the forest on 4th April, 1933, to examine possibilities of a road making scheme for the relief of unemployment, but decided against the proposal.

The Chairman inspected the remaining old plantations and some of the newer spruce planting on the high lying Molinia on 10th August, 1933, and recommended all future work should be confined to Japanese larch and Sitka spruce with the possible addition of beech for beating up. He commented on the waste in beating up the older Japanese larch with Sitka spruce.

In April, 1934, Margam Forest was revisited by Mr. O.J. Sangar, who recorded that the older plantations had "developed patchily" and that the newer plantations, mainly spruces, were mostly still checked.

The Assistant Commissioner (Mr. W. L. Taylor) and Divisional Officer toured part of the forest on 10th April, 1935, and reference is made to falling off of height growth in older Sitka spruce on dry bracken or bracken/Vaccinium slopes: attributed to recurrent attacks of Neomyzaphis abietina which were first noticed in 1931. An invasion of rabbits in Compartments 11 and 12 from Hafod Farm is recorded, and comment made that previously there had been no need to protect against rabbits.

On 8th May, 1937, Sir Alexander Rodger, Forestry Commissioner, visited the forest in company with District Officer G.W. Backhouse and, in addition to commenting on the growth of the different species and the unnecessary beating up with Sitka spruce, Corsican pine and Japanese larch, has stated "On the whole it (the forest) looked better than I expected from what I had heard".

During the Chairman's tour of 28th July, 1937, in addition to requesting the establishment classification of poor grade old areas, criticism was directed at the choice of species on a number of areas, the excessive beating up carried out from time to time and the uneconomic weeding going on at the time of the visit. Subsequently, the Chairman minuted: "I feel

that we have been spending too much money on this place, and very little to show for even current work. I should like to have proposals based on the employment of a limited staff".

At a meeting held in Divisional Office, Cardiff, on 15th November, 1938, attended by the Chairman, Mr. (now Sir) W. L. Taylor, and the Assistant Commissioner (Mr. O. J. Sangar):-

"It was agreed that, in view of work now being done on tractor ploughing and capital formation of tractor-cultivated firelines, the policy should be to replant the whole area at a reasonably rapid rate and not to restrict re-afforestation to a small area each season, as hitherto intended."

The foregoing refers to the re-afforestation of the remainder of the burned areas where re-ploughing with the equipment then in use had been giving trouble because of the old drains, turf drains and in places old plough furrows.

The Assistant Commissioner, Mr. A. P. Long, visited Margam on 2nd and 3rd May, 1940. By this time the P.27 European larch in Cwm Goblyn had been "reconditioned" with Japanese larch at a cost of 40/- to 45/- per acre: the Norway spruce and beech beat ups being left to grow on: only the useless European larch were cut out. The importance of the ploughed firelines was stressed, and the value of the hardwood firebelts was questioned.

The Chairman again visited the forest on 29th March, 1942, and in his note stated: "This is a distressful forest where things seem almost invariably to go wrong..... Our general experiences at Margam have been such as to make us think carefully before we acquire further land in the neighbourhood".

On 5th June, 1947, Director (Wales) accompanied by the Conservator etc. toured the main block and, in course of inspection, saw the results of thinning in several of the older stands, such as P.23 Japanese larch in Compartments 12 and 24 thinned in F.Y.43/44 and again in F.Y.47, P.29 Japanese larch in Compartment 10 first thinned in F.Y.46, and P.21 Scots pine in Compartment 19. The Director also visited the Molinia top (Compartments 42 and 43) close ploughed and planted to Norway spruce in P.41, which was held to be a good example of the results capable of achievement in the South Wales Coalfield. As a result, Mr. Long minuted:-

*W of  
fire tower*

*? Sika*

"I see an improvement in most plantations each time I visit this forest. Its history notwithstanding, we may look for quite presentable results from the older plantations. Unquestionably the younger plantations which have been formed on deeply ploughed ground are greatly superior to the older ones formed by earlier methods, and the present evidence shows that we need not hesitate to plant similar land in this locality. There are large areas of such land in the industrial belt, we have acquired a considerable acreage and should continue to acquire more as it comes on offer. As a long term project it has the decided advantage that pitwood will be available in due course on the doorstep of the coalfield".

The Director General, on 6th April, 1950, inspected the Cwm-wernderi area, and saw typical examples of the surviving old Japanese larch and Douglas fir plantations, the early horse ploughing for spruces, Norway spruce/ Scots pine single row mixtures, and some of the older Corsican pine and Sitka spruce plantations. In commenting on pine/spruce mixtures, particularly the undesirable single row type, the Director General stated that, while thinning might have the general object of favouring the spruce, each stem should be treated on its merits and the mixture preserved. Observing something of the current road making activities, the Director General remarked on the tendency everywhere to do too much work and be over-elaborate.

HISTORY OF MARGAM FOREST

APPENDIX II

SUPERVISION

The following is a list of the various Officers in each grade who have, at one time or another, been in charge of the forest:-

Conservators

1946 - 47	R. G. Broadwood
1947	W. A. Muir
1947 - 49	G. B. Ryle
1949 to date	W. D. Russell

Divisional Officers

1921 - 22	W. H. Lovegrove
1922 - 31	C. O. Hanson
1931 - 38	F. Scott
1936 - 39	G. B. Ryle
1938 - 43	F. Cownie
1943 - 46	R. G. Broadwood
1947 - 49	W. D. Russell
1949 to date	J. T. L. Fitzherbert

District Officers

1921 - 24	O. J. Sangar
1924 - 26	R. G. Broadwood
1926	L. A. Newton
1926 - 29	R. G. Forbes
1929 - 34	G. B. Ryle
1934 - 37	G. W. Backhouse
1937 - 39	R. Cowell Smith
1939 - 44	G. E. Godwin
1944	G. Lowe
1944 - 51	J. H. Currie

Note: J. H. Currie is being transferred to Private Woodland duties and is being succeeded in January, 1952, by J. White from S.E. (E).

Foresters

1921 - 22	McMillan (borrowed from Margam Estate)
1922 - 25	Herworth
1925 - 28	G. W. Hollis
1928 - 30	Rowlands
1930 - 32	L. T. Edwards
1932	Johnstone
1932 - 33	N. A. Wylie
1933 - 34	T. N. Browne
1934 - 37	N. D. Rodger
1937 - 43	A.T.G. Gunter
1943 - 51	T. Morris
1951 to date	D. M. Morgan

APPENDIX III  
TABLE I

TOTAL AREA = 5636.729

From	By	Date	Plantations Acquired	Plantable (Excluding Col.4.)	Nurseries	Agricultural	F. W. H.	Unplantable (Excluding Col.4.)	OTHER LAND			Total	
									Land permanently Transferred	Land temporarily Transferred			
										Description	Acreege		Description
Sir T.M. Franklen and Others	Lease	24.12.25	Nil	957.335	Nil	Nil	Nil	Nil	-	-	-	957.335	
Sir S.C.L. Dillwyn-Venables-Llewellyn and Others	Lease	29.10.29	Nil	566	Nil	Nil	82	182	-	-	-	829.619	
Sir Rhys Rhys Williams and Others	Lease	26.4.40	Nil	3.878								3.878	
John George Gray Esq.	Lease	12.11.48										1026.298	
Fritz Cysyll Knight Esq.	Lease	25.11.48										553.126	
Geo. Coldham Knight Esq.	Lease	19.11.48	Nil	2448.897	Nil	250	Nil	71	Agricultural	340	Plantable Agric. Un-plantable	672 35 29	662.563
E.W.S. Bartlett Esq.	Lease	11.10.48											239.364
C. D. Terry Esq.	Lease	1.12.48											514.415
J. G. Gray Esq.	Lease	25.4.49											127.279
Mrs. Dorothy F. Place	Lease	21.4.49											722.582

APPENDIX IV

Summary of Silvicultural Data from War Fellings compiled in 1942

Name of Wood	Site Description					Type and Condition of Crop					Quality Class
	Area Acres	Topography and slope	Elevation Aspect & Exposure	Soil	Vegetation	Species	Type of Forest	Form of Boles	Stocking	Soundness	
Owm Kenfig	50	East face of N/S valley steep	700 feet West Sheltered	Sandy loam 18"/20"	Frequent Vacc; Aira Flex; Mosses	S.F. oak coppice other coppice EL/NS etc.	High Forest 60% 20 ) Lower 20 ) Storey	Mod. straight	Canopy complete or nearly so.	Sound	S.P. Q.C.II (50 ft) at 65 years. 120
Owm Kenfig	3	High upon N.E. valley side. Moderate to steep.	900 feet SxW moderately exposed	Sandy loam 18"	Nil. Marginal bracken, Aira Flex; Agrostis	C.P. 90% S.F. 10%	Even aged High Forest	Mod. straight.	Canopy complete.	Sound	Q.C.II (60 ft. at 50 years) at 27 and 35 years 140
Owm Kenfig	10	On N.E. slope steep.	750 feet S.S.W. Sheltered	Sandy loam	Nil, Marginal herbage, Bracken Aira Flex; Agrostis	S.P. and E.L. over EL/NS Hw. coppice	Uneven aged 20% Forest	Mod. straight to crooked.	Canopy complete or nearly so.	Some slight decay.	S.P. Q.C.II at 46 years. 120
Owm Kenfig	3	East slope steep 25°	550 feet N.W. x W. mod. exposed.	Loam 20"	Scanty. Bracken. occ. Vacc; Aira Flex.	J.L. 100% over sporadic oak coppice	Even-aged High Forest	Mod. straight	Canopy complete or nearly so.	Sound	Q.C. II at 23 years. 140
Owm Kenfig	1/4	East side 10/40 ft. above stream moderate	400 feet W.N.W. sheltered	Red loam to 2 feet.	Nil, marginal bracken, Aira Flex, oxalis Aira, Cassp: etc.	S.S. 100%	Even-aged High Forest	Straight	Canopy complete or nearly so.	-	Q.C. II at 22 years 240
Owm Kenfig	10	East side of valley on concave slope moderate.	450 feet West Moderately exposed.	22" friable red loam over clay loam.	Frequent bracken, Aira Flex; mosses, vaccinium.	Oak 80% Beech 20%	Even-aged High Forest	Mod. straight for 20/30 feet.	Canopy complete or nearly so.	Sound 11 Stained 3 Slight Decay 9 Severe Decay 2/25	For 1st 40 yrs growth of 1ft. p.a. thereafter v. slow. Far frx good.
Owm Philip	1/4	Low down on N.W. slope of NE/SW valley. Steep 25° to 30°.	400 feet S.E. Sheltered.	Over 20" red brown sandy loam.	Nil, marginal flora bracken.	S.S. 100%	Even-aged High Forest	Mod. straight	Canopy complete or nearly so.	Sound	Q.C. III at 20 years. 200
Owm Philip	10	On N.W. slope of N.E/S.W. valley Steep 30°	500 feet S.E. Moderately exposed.	Over 20" red brown loam.	Nil. Marginal bracken.	J.L. 100%	Even-aged High Forest	Mod. straight	Canopy complete or nearly so.	Sound	Q.C. I at 21 and 29 years. 160
Owm Philip	2	On S. side of E/W valley 2/3 up side moderate convex.	650/800 ft. N. mod. exposed.	At least 20" yellow loam.	Scanty. Mosses; much bracken in open on both sides.	Beech 100%	Even-aged High Forest	Straight	Canopy complete or nearly so.	-	Age over 100 yrs. QG (b.l) 13/19". Log 35 50ft. Ht. 90/100ft. Excellent up to 700' contour, marked falling off between 700 & 750'.
Craig Owm Maelwg	25	Screened to N.W. & S.W. Steep 25° to 30°	600 feet S.E. Mod. exposed.	Sandy loam over 15".	Frequent Bracken 4ft.	S.P. 90% Beech 10%	Even-aged High Forest.	Mod. straight to crooked.	Canopy complete or nearly so.	Sound 3 Stained 1 Slight decay 1/2 Severe decay 1/4	Q.C. II at 59 yrs. probably Q.C.III at 123 years. 160
Craig Owm Maelwg	1	W. side of narrow valley. Moderate	450 feet S.E. Sheltered.	Sandy loam over 20".	Nil. Marginal bracken 4/5 ft.	S.S. 100%	Even-aged High Forest	Straight	Canopy complete or nearly so.	Sound	Q.C. III at 16 years. ?
Craig Owm Maelwg	10	W. side of valley. Moderate 15 to 25°	750 feet S.E. Mod. exposed.	Sandy loam 12/16".	Scanty Bracken, Aira flex; mosses.	J.L. 100%	Even-aged High Forest	Mod. straight	Canopy complete or nearly so.	Sound	Q.C. I at 24 and 40 years. 160



APPENDIX IV (cont.)

Name of Wood	Site Description					Type and Condition of Crop					Quality Class
	Area Acres	Topography and slope	Elevation Aspect & Exposure	Soil	Vegetation	Species	Type of Forest	Form of Boles	Stocking	Soundness	
Cwm Maelwg	1	Near head of Cwm Maelwg at margin of wood. Steep 33°	850 feet. East. Mod. exposed.	Loam 12" or more, over clay loam.	Nil. Outside stand much bracken, Nardus etc.	N.S. 100%	Even-aged High Forest	Straight	Canopy complete or nearly so.	-	Q.C. III/II at 42 years. 170
Cwm Maelwg	2	West side at head of Cwm Maelwg moderate.	900/950 feet. E.S.E. Very exposed.	Loam 8" very stony from 8"/24".	Scanty, patches Aira Flex outside above wood, bracken.	S.P. 70% C.P. 30%	Even-aged High Forest.	Straight for 20/30 ft., crooked tops.	Canopy complete or nearly so.	-	Q.C. III at 38 years. 80
Cwm Maelwg	5	Half way up W. side of narrow valley. Moderate.	750 feet E. x N. Mod. exposed.	20" sandy loam over stony clay loam.	Nil. Marginal dense bracken, Aira Flex; mosses.	N.S. 100%	Even-aged High Forest	Straight for 45 feet.	Canopy complete or nearly so.	Sound 1 Slightly stained 2	Q.C. V/IV at 68 years. 80
Cwm Maelwg	10	Half way up W. side of N/S valley on mod. even slope.	750 feet E. x N. mod. exposed.	Sandy loam over clay loam.	Scanty, Aira Flex; mosses, Holcus.	J.L. 80/90% E.L. 10% Few D.F.	Even-aged High Forest	Straight or mod. straight	Canopy complete or nearly so.	Sound 19 Slight decay 1	Q.C. I/II at 27 years. 120
Cwm Maelwg	10	Half way up W. side of N/S valley on moderate slope.	750 feet E. & N. mod. exposed.	Sandy loam over clay loam.	Scanty, Aira Flex; mosses.	J.L. 80/90% E.L. 10 Few D.F.	Even-aged High Forest	Straight D.F. Mod. straight E.L.	Canopy complete or nearly so.	Sound	60 125 J.L. 66 ft. E.L. 60 ft. D.F. 62 ft. Age abt. 40 years. 240
Cwm Maelwg	1/2	W. side of narrow valley gentle.	400 ft. S.E. sheltered.	Sandy loam over 20".	Nil. Marginal bracken 4/5 ft.	S.S. 100%	Even-aged High Forest	Straight	Canopy complete or nearly so.	Sound	Q.C. II (90ft. at 17 and at 25 years.

MARGAM FOREST HISTORY

APPENDIX V

SOUTH WALES SPECIAL AREAS  
MEETING HELD AT DIVISIONAL OFFICE (9)  
ON 28th JULY 1937

Present: The Chairman, the Assistant Commissioner, Mr. Scott, Mr. Ryle, and Mr. Cowrie.

The discussion then entered upon the silvicultural policy to be adopted within the Coal Measures forests where smoke and fume factors are of importance and the lessons learned from the Commission's earlier work at Llanover, Llantrisant, Margam and Rheola were examined with special reference to inspections which had been made during the previous three days.

(1) Choice of Species

It is at once evident that future selection of species for planting on the Coal Measures must be confined to the known hardy types. The biggest mistake in the past has been in the use of comparatively exacting species which, while they were expected to give rapid increment and early pitwood returns have, in fact, proved to be dismally unsatisfactory.

Douglas fir and European larch must be absolutely excluded. Of the several hundreds of acres previously planted with these two trees (up to P.27 in the case of Douglas and up to P.30 in the case of European larch) the proportion of reasonably thrifty crops is very small. The Frazer River type of Douglas continues to show slight improvement from year to year but not enough to justify its continued use anywhere.

Scots pine must be used only on a small scale and generally only as a nurse crop for other species. Early promise from this tree has been largely negatived by the recent severe infestation of Evetria buoliana which has become increasingly serious during the past three or four years. Risk of Honey Fungus must preclude its use on felled woodland, coppice and scrub areas.

Corsican pine will be used on a larger scale on hard soil types but should not be planted at high elevations for fear of Brunchorstia destruens. The risk of wind-sway in the pre-canopy stage should not be serious provided that it is kept off soft ground and that careful planting methods are used.

Japanese larch is vigorous on all reasonably sheltered sites and

typically on bracken clad lower or middle slopes. Generally, its upper limit should not be above 800 ft. elevation. The only real risk so far known is from steady blast exposure which produces a rough sabre-shaped tree.

Sitka spruce is generally sub-normal in early vigour but is adequate up to the pre-canopy stage. Insufficient data are yet available but it appears certain to be the best tree on exposed sites where not too dry. The main risk is from frost in valley bottoms and lower flats. Honey Fungus is severe on old woodland, coppice and scrub areas and these sites should be avoided. Neomyzaphis is not likely to be in itself of primary importance.

Norway spruce is vigorous in sheltered and damp places and is safe from frost and Honey Fungus. It must be used more in the lower damp sites where Sitka is to be avoided. Prolonged check in Calluna and Vaccinium and blast in exposed places are the risks to be avoided.

Beech: From the rather scanty evidence available this tree will appear to be suitable for more extensive use on the average to good soils. It has not suffered severely from frost even in valley bottoms. Nursed up with pines and larch it is giving good promise at Llantrisant and Margam. A pure plot aged about 20 years at Aberpergwm (Rheola Forest) is making reasonable but rather rough growth and it appears that a nurse species in mixture will be the desirable normal procedure.

Sycamore appears to be vigorous even under the most severe smoke conditions. There is insufficient evidence of its growth in young plantations. Experiments on good ground in smoky areas may be made with Platanus and Ailanthus.

By locality types the following must, in future, be the general principles of species distribution:-

- (1) Valley bottom: Frost zone, adequate moisture, good deep soil, frequently with coppice or scrub growth.

Norway spruce                      Beech                      Sycamore.

- (2) Middle slopes: Deep soil, mainly bracken.

Japanese larch with beech and sycamore as subsidiary species.

- (3) Middle slopes: Shallow dry soils, convex contours, Calluna and Vaccinium. Mainly Corsican pine but with some Scots pine.

- (4) Middle slopes: Flush type, Juncus and Molinia.

Norway spruce and subsidiary Sitka spruce.

(5) Upper slopes: Exposed, dry, sometimes shallow soil.

Nardus and Vaccinium with some Calluna

Pine-spruce mixture with about 50% of each.

Generally Corsican pine and Sitka spruce.

(6) Top land: Shallow peat, clayey loam and stones, much Molinia.

Sitka spruce after ploughing. Where ploughing is impossible must be turf planted.

#### Past Failures.

The primary reason for the poor condition of many of the older plantations has been as a result of wrong choice of species, especially in the extensive use of Douglas and European larch.

Failure to keep the poor plantations weeded after they had begun to show clear signs of unthriftiness, belated beating up after a similar pause and failure to keep the beat-up plants clear of annual and coppice weed growth have been secondary though equally important.

Many of the poor plantations had been beaten up with Sitka spruce which was severely injured by the 1935 frost while on coppice areas it has suffered from Honey Fungus.

Norway spruce on heather and exposed sites have also been unthrifty.

#### Future Technique

In future most of the difficulties encountered in the past can be avoided by rigid adherence to the following principles:-

1. Choice of species, by avoiding the use of any of the exacting species.
2. Use of the right type of plant: under the difficult conditions prevailing only really good plants must be used.
3. Method of planting to ensure optimum of root development.
4. Timely and adequate weeding.
5. Immediate beating up of failures.

The effect of proper attention to these rules may be to limit the planting programme. In such cases the rule is always to be "The existing plantations are to receive the first consideration."

It is further fully realised that careful attention to the above points may result in increased costs of formation. If anything, however, actual

cost of establishment should certainly not be increased. The point was also mentioned by the Chairman that the results of our work in the Special Areas would be partly judged by the amount of labour employed, and it would, therefore, be even more advantageous to conduct the formation works with unusually careful methods.

### Spacing.

In order to ensure early canopy formations to speed up establishment and reduce grass fire risk, the following spacing of plants is in future to be adopted:-

All pines, spruces (including Sitka spruce) and hardwoods 4 ft. 6 in.

Japanese larch ... .. 5 ft. 0 in.

Mixtures of species within the above to be according to silvicultural requirements of the species to be nursed up.

### Planting

Quick methods of notch or mattock planting which do not give the optimum conditions for root development are to be avoided. Spruces, where not turf or plough-ridge planted, to be shallow notched: all other species to be deep planted with adequate precautions to ensure careful distribution of the root systems.

### Weeding

Early and thorough weeding, especially for Japanese larch and pines will be essential in order to preserve their lower foliage, to encourage quick canopy formation and firmness. Weeding must continue until plantations are really completely established.

### Beating-up

Japanese larch and pines must always be completely beaten up after the first season and spruces not later than the second season.

Japanese larch to be beaten up with Japanese larch when done after the first growing season. Any necessary later beating up to be done with beech. Spruces never to be used.

Pines to be beaten up with pines in first season. Later work can be done with Sitka spruce or beech.

Norway spruce to be beaten up with Norway spruce. If the work is delayed

for any reason Sitka spruce may be used.

Sitka spruce to be beaten up with Sitka spruce.

Establishment of older plantations.

The time has now arrived when certain of the poorer old plantations must be definitely scheduled as established and in these no more work must be done until canopy (mixed plantation and coppice) has been formed and they can be cleaned up from beneath. Continuation of beating up and almost endless weeding in some of these crops is becoming quite uneconomic.

Such areas are to be scheduled as quickly as possible by District Officers who will be supported in their reasoned decision to class them as established for this purpose. It is fully realised that such classification may in many cases involve the sacrifice of the more recently introduced beat-up plants.

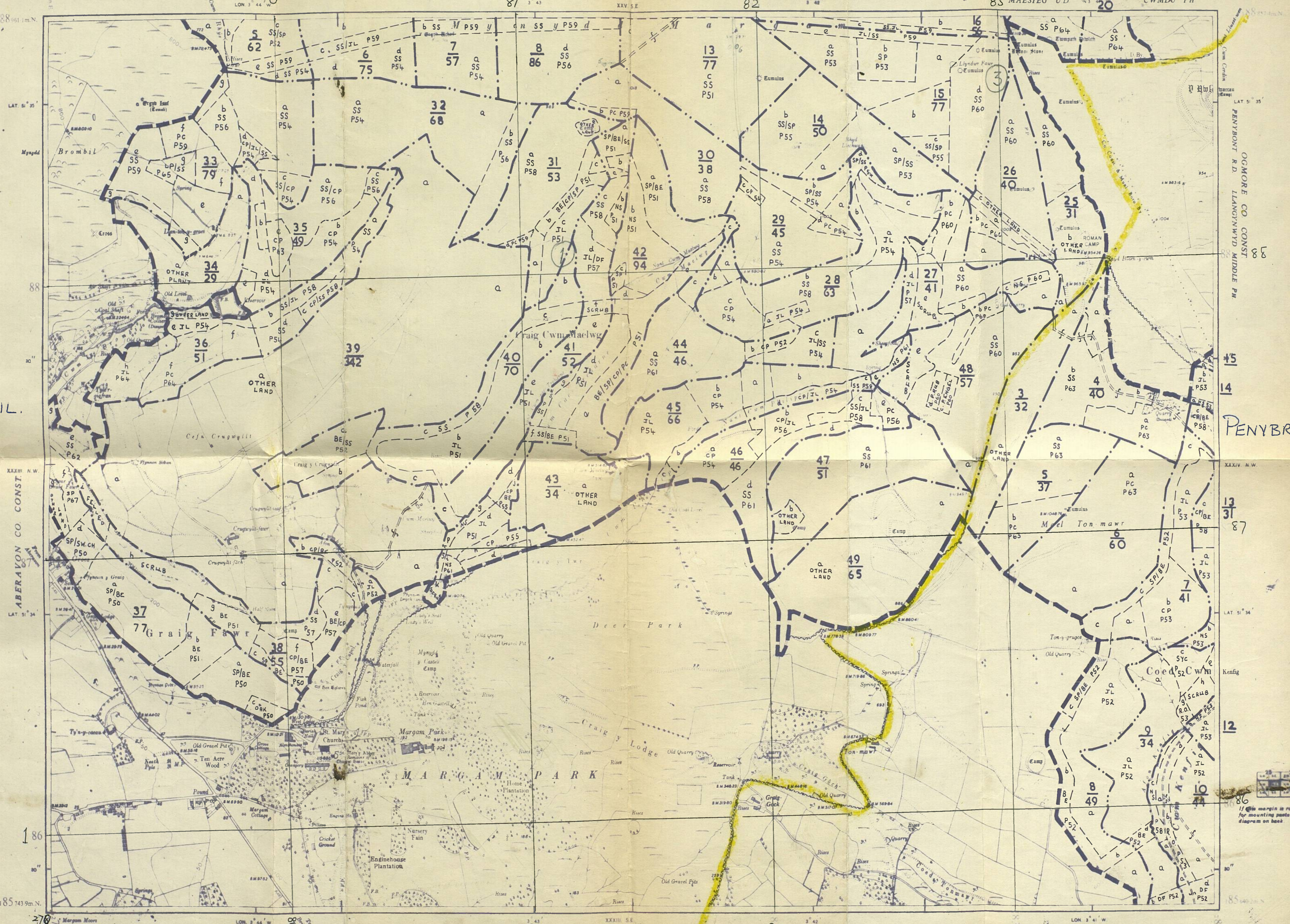
The beating up of many of the older plantations with Sitka spruce, which has been done on a very large scale, has demonstrated that under many of the conditions prevailing (e.g. heavy weed growth, coppice and frost conditions) this has been the wrong species to use.

George B. Ryle

Actg. Divisional Officer.

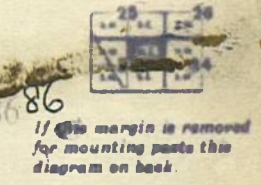
4. 6. 37

Margam



185 911 m. N.  
 LAT. 51° 35'  
 88  
 80'  
 OMBIL.  
 XXXIII. N.W.  
 ABERAYON CO. CONST.  
 LAT. 51° 34'  
 186  
 80"  
 185 743 9 m. N.  
 279

OCMORE CO CONST  
 PENYBRYN R.D. LLANGYWDYD MIDDLE PH  
 88  
 85  
 84  
 83  
 82  
 81



If the margin is removed for mounting paste the diagram on here.



Revision of 1913-14 with additions in 1947.

PROVISIONAL EDITION.

Copy: Counselor S(2) of 3F5/2 of 17.9.65.  
MURGAN SS. Coops, older, Bryn Beor

GLAMORGAN. SHEET XXV. S.E.

ABERAVON CO. CONST.

BRYN

COED MORGANNWG

Lon 3° 44' W

Lon 3° 44' W

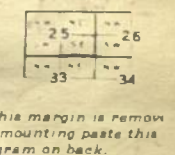


3300  
3000  
2500  
2000  
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slow and  
Doubtful  
West  
Satisfactory

BRYN

- TOWER
- 1 R C40 P40wcl  
L DRAINAGE IN CUTY
  - 2 C435 P39  
C46E
  - 3 41 N SS P41  
S CP P40
  - 4 C50/51 SS P34  
CP P40 SS (CP) P40
  - 5 C 51/52 NS/CP P31/32
  - 6 C 55 CP P23 SS P23
  - 7 C56 N → S SS P31



If this margin is removed for mounting paste this diagram on back.

Surveyed in 1875. Re-levell'd in 1948-49. Boundaries Revised to 3-2-1950.

PORT TALBOT PH

Lon 3° 44' W

Scale - Six Inches to One Statute Mile or 690 Feet to One Inch = 1828



CHARACTERISTICS AND SYMBOLS

- County Boundary
- County or Borough Constituency Boundary
- Rural District Boundary
- Parish Boundary
- Antiquities Site of
- Arrow showing direction of flow of water
- Instrumental
- Contours
- Stashed

The Altitudes of Bench Marks and surface heights are given in Feet above the mean level of the sea at NEWLYN and are based on the primary levelling of 1912-21.

To refer levels to Liverpool Add 2.04 Feet. Note that the figure applies to this plan only and is approximate to 0.1 ft.

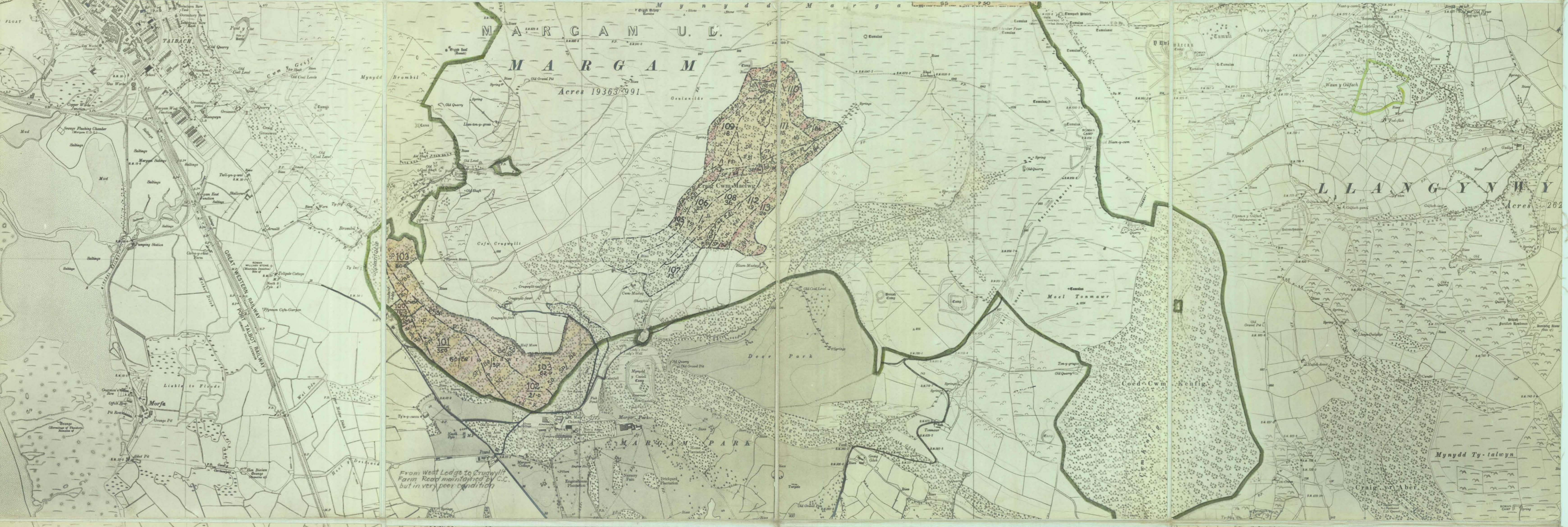
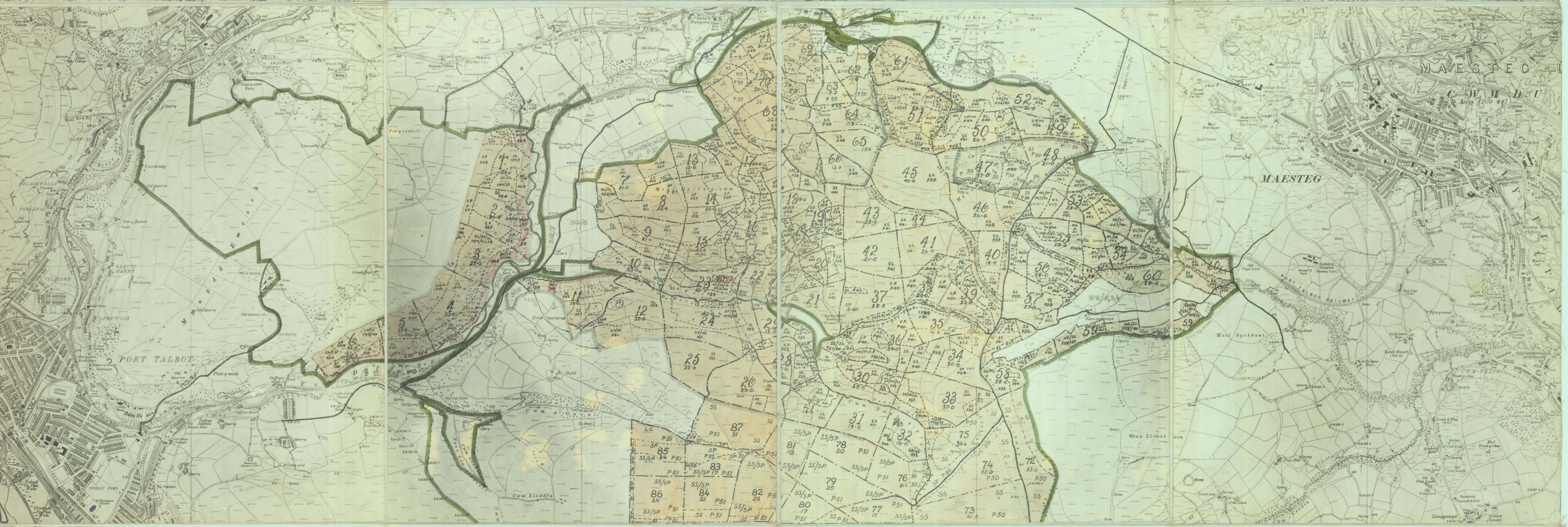
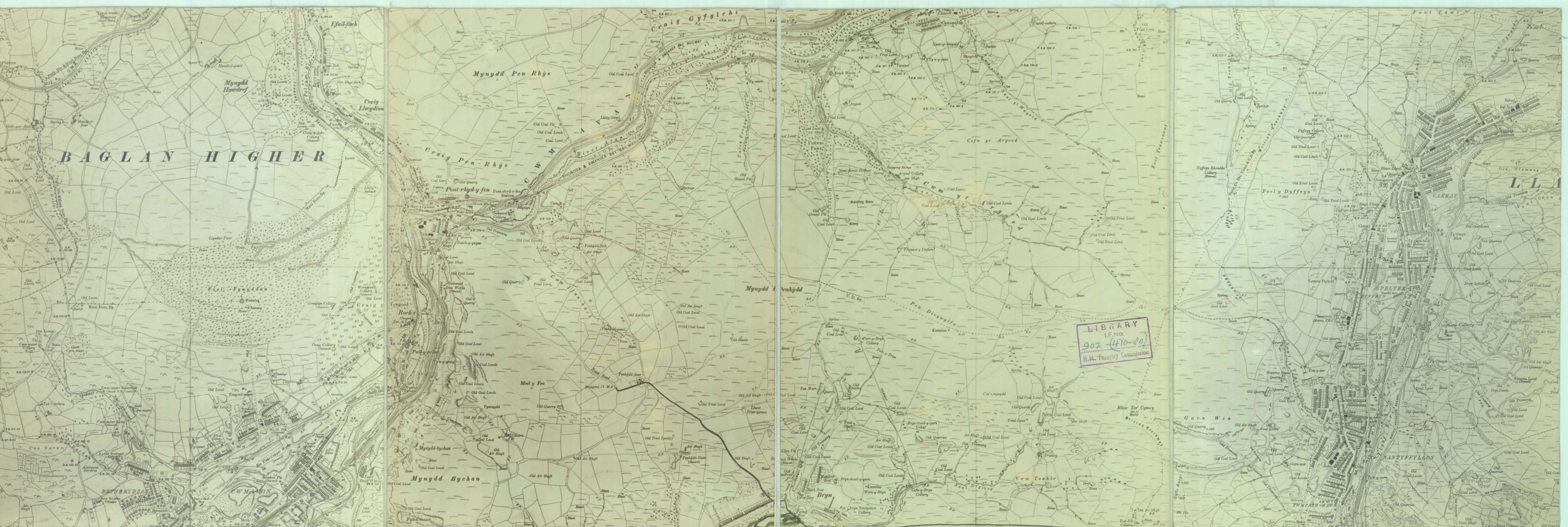
Further information on Appendix 1.

Altitudes indicated thus (B.M. 54-17) refer to bench marks on buildings, walls, &c. Those marked 'pre-dred' or 'follow-up' by the height, refer to surface levels.

Bench Marks shown thus \* have been neither re-levell'd nor examined on the ground. The above approximate correction has been used to convert them to Newlyn Datum.

B.M.'s which are likely to remain stable in areas generally liable to subsidence.

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