JOURNAL

OF THE

FORESTRY COMMISSION.

No. 3: FEBRUARY, 1924.

Editing Committee:
R. L. ROBINSON,
A. W. BORTHWICK,
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FRASER STORY.

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EDITORIAL.

Contributions to the Journal.

INTENDING contributors are requested not to wait for a reminder before sending in MS. The Editing Committee are unable to devote specific time to their task and can more easily deal with a steady flow of articles. The first article by a member of the clerical staff appears in this issue. It is hoped that the good example will be followed by others.

Library.

STANDARD books may be obtained on loan from the library on application to the Publications Officer, 22, Grosvenor Gardens. Books borrowed in this way may be retained for a fortnight. It is proposed to publish in this Journal from time to time lists of additions to the library.

Apprentices' Schools.

THE articles in the last number of this Journal have served a very useful purpose in drawing attention to the inadequacies of the existing system of educating foresters and in suggesting remedies. Broadly the objections can be grouped under the following heads :—

(1) The material sent to the schools to be trained.

(2) The character of the courses at the schools.

(3) The inducements offered in the State Service to men leaving the schools.

As regards the first there is no doubt that we require men with a reasonable standard of general education. Without this the work of the instructor must crumble away from lack of a foundation on which to build. Again, an apprentice who has not been through the mill and acquired some "forest sense" is not likely to acquire it in the school. There will be to him an air of unreality about the whole business and he is unlikely on leaving the school to take kindly to the work as a ganger which, as we have seen, has been considered derogatory in certain cases.

There should be a satisfactory middle course between the extremes of attempting in the schools to teach the mature practical man theory and the totally inexperienced youth theory with some practice. The older the man the more "set" his mind will be, the greater the difficulty

of teaching him and the greater the difficulty of getting him to a school at all. On the other hand, it is possible to fill the schools with very young men and see them drift away into other forms of employment at the end of an expensive training.

As regards the courses at the school it is stated that they do not turn out a sufficiently practical man for the Commission's present work. This is a difficult point. Apart from the fact that the schools also train men for the present Crown woods, private estates and the Colonies (in all of which the work is of a more varied character) it is necessary to remember that some at least of the apprentices will remain in the State service for 40 to 45 years and may be called upon to supervise all the normal operations of a forest. An educational foundation which is too narrow is not likely to prove satisfactory.

In the first two issues of this Journal the views of Divisional Officers and School Instructors have been given regarding the system of training in the Commission's schools, and the results as indicated by the efficiency of the men turned out. The discussion has served a useful purpose and the weak points in the system of training have been brought to light. But the main weakness, in the system of training, seems to be that the trainees lack experience or confidence in organising and guiding the work of men under their charge.

In general no school training fits a man immediately to exercise the full functions of his profession, but merely places him in a better position than the untrained man for developing into an efficient practitioner. The forest officer on leaving the University is not qualified to run a district; experience and direction under older men are first required. The Divisional Officer can usefully spend a little time and trouble in getting the apprentice over the difficult transition period between the school and direct responsibility for operations. The instructors on their part should make a point of ascertaining the nature of these difficulties and devise means of meeting them. In other words the full responsibility of the instructor does not end in the school.

The wider question of training in all forestry operations must be kept in mind, and as yet the practical test of the efficiency of the trainees has been largely in one phase of practical work only, *e.g.*, nursery work and planting.

A knowledge of the laws of plant growth and the general principle upon which silvicultural operations and working plans are based, will, undoubtedly enable a forester, who has gone through the school, to carry out instructions and perform his work more intelligently and efficiently than the mere skilled labourer who has picked up his knowledge, as far as it goes, through practice alone.

A distinction must be drawn between the British forests of the present time and those of the future, say 40–45 years hence, and it is quite possible that some at least of the apprentices now being trained will remain in the State service for that time.

The discussion has shown that, in the first place, much will depend upon the standard of general education of the candidates selected for

training, and in the second place the rate at which experience and confidence can be gained in applying school training to practice.

The inducements which the Commissioners offer to efficient apprentices should not be under-rated. The prospects compare well with other forms of rural employment and most trades. The probabilities are not so much that the Commission will find it difficult to promote good men as that they will be unable to find the men to promote.

Science and Practice.

THE value of co-operation between science and practice is well illustrated by the interesting account of an attack by *Strophosomus lateralis* on Douglas fir at Churt contributed by Mr. H. Blows. The attack occurred in the spring of 1923. Specimens of the insect and damaged plants were immediately submitted to Dr. Munro, the Commission's Entomologist, who identified the weevil, and the prompt information he was able to give of its life history and feeding habits threw light upon the cause of the attack, and at the same time indicated how such damage might be avoided in future.

It is highly desirable that in all cases when the first symptoms of damage or unhealthiness appear, that the executive officers should immediately get into touch with the research officers, as it is in the early stages of disease that the most effective remedial and preventive measures can be applied.

THE OBJECTS AND SCOPE OF THE FORESTRY COMMISSION'S EXPERIMENTAL AND RESEARCH WORK.

It is the spirit of inquiry which above all else has lifted mankind from the nomadic tribe to present day civilisation. The history of the development of forestry is a miniature of the general evolution. Decade by decade increasing knowledge has led to advances in the science of forestry. The accepted methods of the day were varied and any resulting improvements were gathered into the store of accumulated experience. When the spirit of inquiry was active the purple patches of forestry development followed and when that spirit was sluggish the grey days were at hand.

First of all it is necessary to define what is meant by these two handmaidens of the spirit of inquiry, namely, research and experiment. In the sciences, research is the name given to the study of the form and function of an entity or unit of nature. Typically, therefore, research deals with individuals or units. The experiment is quite different; it may be defined as the study of the influence of factors or conditions on an entity or unit. In the ideal experiment there is only one variable, *i.e.*, all the conditions or factors are kept constant but one; it is varied and the influence on the entity under study is recorded. Let us take an example to make these definitions clear, say, a new fungus disease attacking nursery stock. The first step is to carry out research to determine the form and function of the fungus. When everything is known about it, it may be considered necessary to study how certain conditions affect its development. This second step constitutes a series of experiments. Each of these conditions or factors is taken separately. For example, one of them may be density of sowing. All other factors, *e.g.*, treatment of seed, depth of sowing, etc., are kept constant, and this one factor, density of sowing, is varied, the fungus being introduced equally throughout.

Research work is essentially work for the specialist. Experiment, on the other hand, may be considered something which all can do. When operations are on a small scale and largely individual, methods may be plastic. A worker can vary accepted practice either by fancy or on the basis of some knowledge he has obtained and any improvements which result constitutes an advance. Under such conditions all may be experimenters without greatly interfering with the general conduct of the work. When, however, we come to large scale operations, such as we have in modern industry including national forestry, it becomes more and more essential to stereotype practice for reasons of safety and organisation. This decrease in plasticity must tend to slow down the improvement of practice, and it is the recognition of this which has led to special experiment as well as research branches. This specialisation of experimental work has led to an improvement in its technique. It has been recognised that numerous repetitions are necessary to ensure reliable results. Different methods are applied not to one bed or plot only, but to a number which are arranged to ensure that chance factors, such as, for example, unknown variations of soil, will not operate in one direction only, and thus vitiate or obscure

the study of the particular factor under study. Repetition is necessary also over a period of seasons. Further, modern statistical methods, which were first elaborated to deal with social statistics, are now being applied to investigation work in all branches and countries. The degree of confidence which may be placed in results can now be accurately determined.

There is, however, one danger in the separation of the executive and investigation branches which must be guarded against, namely, the drifting apart of the two branches. The closest contact and co-operation between them is an essential condition for the best results.

In the first place it is the general executive work which indicates in what directions knowledge is deficient and improvements are necessary. Thus failures or comparative failures may be valuable as indicators. It is human to cover up one's failures, but by so doing progress is impeded. Every failure should be judicially examined by the executive officer, lest at the bottom of it there may be some problem which calls for study and investigation, *i.e.*, the calling in of the experimental and research branch.

Secondly only close co-operation between the two branches will ensure that future problems will be foreseen and information obtained against the day it is required. Lastly, the executive officer being in close touch with operations is often in a position to indicate the lines along which there is a probability of improving existing practice. Conversely close co-operation between the executive and the experimental branches will aid in the putting into practice of results obtained by research and experiment.

The objects of the research and experimental work of the Commission may thus be summarised as follows :—

(1) The progressive increase in forestry knowledge leading to improved practice in the rearing of nursery stock, the formation of plantations and their protection.

(2) The investigation of the underlying technical problems which are revealed by the breakdown of existing practice under certain conditions.

(3) The looking ahead to these problems which will be met and the study and solving of them so that progress may be continuous.

Turning to the scope of the work it is, of course, limited by means. The investigations to date have revealed very large fields which require both fundamental research work and careful experiment. On the research side, diseases and pests are always with us and much work will require to be done to ensure the safety of our plants both in the nursery and in the forest. Research work on roots has been found to be necessary to supply lack of essential knowledge. Until this is completed advances in certain directions both in nursery practice and in the field, especially on specialised sites such as peat, will be impossible.

The experimental work consists of two sections—nursery and plantation. In England the nursery experiments are largely centralised in the Windsor nurseries, while in Scotland the two principal

centres are Edinburgh and the Forest School at Beauly. This centralisation is necessary to ensure adequate control. The planting experiments are of necessity more scattered and these are carried out largely in co-operation with the divisional staffs.

The experimental method is essentially the testing method. On one hand research work may indicate lines along which experiment is necessary. These experiments may give results which can be passed on for incorporation into practice and thus practical advantage obtained from the research. On the other hand practice may indicate methods which require accurate and critical trial. This may indicate advances which can be directly applied in practice or reveal the necessity for research the results of which will in turn pass through experiments into practice. This conception stresses again the need for the closest co-operation of all.

H. M. STEVEN.

UNEMPLOYMENT GRANTS, 1923.

SOUTH WALES.

Procedure.—A list of schemes, by countries and groups, was prepared on a large sheet of paper which included also, in tabular form, the essential details of each grant with blank spaces for filling in actual areas, expenditure, grants sanctioned, etc. Attention was first concentrated upon the arrangement of two or three main tours, each taking in, without doubling on one's tracks, a group of distant schemes, and after considerable correspondence satisfactory appointments were secured, at least two grants being done per day wherever possible; these tours went off without a hitch. Isolated schemes and those near home or close to forests were dealt with as opportunity offered, viz.: whilst on routine inspections to forests, or on odd free days, especially when details of main tours were being settled. The fixing of these latter was by no means easy, partly because it was considered unwise to mention to any one landowner the estate one was next visiting (merely giving the time of the appointment) and partly because it was difficult to estimate from the information provided, the length of time needed for each inspection. In practice these difficulties did not prove serious as owners generally knew quite well whither one was going, and had often, unasked, made some arrangements for transport.

Although the time spent in (MS.) correspondence was considerable, it was worth it; transport was almost everywhere provided free, and no ground was covered twice except in one quite unavoidable case, thus the cost of the work (see below) was kept down to what seems a satisfactory figure.

Statistics.—

Counties covered	6
No. of grant schemes	26
No. of individual areas more than 1 mile apart	41
Miles travelled	1350

Areas concerned—		
(*a*) Planting ..	..	261 Acres.
(*b*) Preparing ground	..	336 ,,
(*c*) Scrub	..	156 ,, (included also in (*a*) and (*b*))
Time occupied—		
Office	..	8 days (estimated)
Field	..	20 ,,
		28 days
Grants sanctioned		£2,139
Cost of inspection—		
Travelling ..		£14
Subsistence		7
Post, etc. ..		1
		£22 viz. 1 per cent. of Grant.

Effect on Other Work.—As all ordinary work was cleared up before starting the grant, it was not seriously affected ; to get it cleared off, however, and to keep it up to date during the inspections kept one working at high pressure. The time occupied on inspections would normally have been spent as follows :—

(i.) Careful preparation of species planting plans, etc., for P. 24 and later.

(ii.) Working plan preparation, including map-work.

(iii.) Preliminary inspections with a view to acquisition.

(iv.) Closer attention to normal work on the estates, especially weeding and fencing.

The time, however, could not thus be spent; the only serious consequences were as regards (iv.) in which weeding distinctly suffered from lack of supervision, and fencing (as regards preparation of stakes as part of preparation of ground) got out of hand on one estate where there had been a change of foresters.

Advantages of Grant Inspection.—If visits are arranged well in advance, one is certain of meeting the owner or agent as well as the forester ; besides settling things on the spot, it is thus also possible to give any advice which may be asked, often saving another (advisory) visit ; furthermore the Commission's local officers become acquainted with their districts and the landowners therein, and have an opportunity of correcting many prevalent misconceptions concerning the Commission's work. The tours, also, are most instructive, particularly in the area under report, where the standard of forestry is often high ; the inspecting officer can gain much profit from the observation of private owners' methods, though there may often be things of which he cannot wholly approve.

Remarks.—It would appear that year, by year, as foresters become more capable of managing their areas without such close supervision, the loss of time involved in grant-inspection will react less and less severely on normal work so that any attendant disadvantages will be reflected rather in administrative duties left undone than in any inefficient execution of normal work.

Whilst extravagant planting costs are still met with on some small operations, on the larger and well-managed estates they do not generally rule much more than fifty per cent. above the Commission's, and the quality of the work is rather better, if not proportionately so. The plants used are, on the average, of better quality, and larger, though much smaller than a year or two ago, and the use of seedlings is increasing, without very encouraging results. The greatest room for economy would appear to be in preparation of ground and in weeding; much unnecessary expenditure is often incurred in the former, the latter is frequently either neglected or done with more care and expense than seem necessary.

Except in plantations designed also for coverts, or for appearance, the choice of species approximates pretty closely to the Commission's practice; in one case only were hardwoods being extensively planted pure.

O. J. SANGAR.

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2. WEST OF ENGLAND.

During the summer months of 1923 I inspected about 40 schemes in the West of England. My method was as follows :—

If there were, say, half a dozen schemes in the same district I went on my motor cycle to the most convenient town, I immediately went to one estate office and arranged to inspect that grant; from that office I telephoned to the other people and arranged to do their schemes, one in the morning and one in the afternoon. This method worked quite satisfactorily until there were only a few schemes left, and then of course I had to write and make definite appointments.

It was of course not necessary to meet the actual owner, and if the agent was away there was usually a forester or woodman or even a clerk in the office that could show me where the ground was, and the pay books.

I should like to point out that it would save some time if the telephone number of the estate office was put on to the application form.

The planting I saw, on the whole, was very good but very expensive, in one place the cost of planting alone amounting to £9 per acre. The plants used were also of a very good quality, but in many cases they were much too large, having been allowed to stay in the nursery quite two years too long.

The inspection of grants is very interesting, as although one doesn't actually see the planting being done one hears of the different methods that have been employed on the various estates; on the majority of cases pit-planting was the order. In no case did I find that planting had been done by piece-work.

I invariably found, on measuring up the area, that the applicant, rather than claim too much had claimed too little. Scrub clearing grants were rather different, and in many cases I had to cut the grant out altogether.

My motor cycle was invaluable, it saved much time and expense, as some of the schemes were as many as ten miles from the railway station.

Taking all the schemes I inspected, I should say that about one day per scheme was the time taken, and the cost (subsistence and travelling only) about 15*s*. per scheme.

Going by rail would have been much more expensive.

G. W. Lowe.

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3. North of Scotland.

These grants have not been taken up very enthusiastically in this Division. Press Notices very frequently left proprietors under a misapprehension as to the scope of the Forestry Unemployment schemes and as to the conditions under which these grants were allowed. Many are now discovering, when too late, that they could have benefited and could have put up schemes which would have been beneficial to their properties and helpful in giving employment. If it had been possible in the beginning for officers to make an estate to estate canvas, much more and better work would have been done under relief schemes. On estates where nurseries did not exist, estimates prepared by the proprietor of the cost of planting, on the basis of current nurserymen's prices for forest trees, were so high that a grant of £3 an acre was little inducement to them to proceed, and several schemes were in consequence dropped.

During the three years of the grant schemes, applications have come in from such widely scattered areas that it has seldom been possible to inspect more than two schemes per day, and frequently single schemes on a large estate have involved more than one day's time of the inspecting officer.

During first inspections the work has been much increased owing to the following :—

(1) The absence in many cases of satisfactory maps of woodlands to be treated.

(2) In quite a number of cases applications have been made for patchy and irregular areas, the limits of which were not shown on the maps available and could sometimes only be roughly indicated by the owner or his representative.

(3) Many desired to have advice before making application.

(4) Frequently with regard to estimates prepared for the purpose of an application the details could not be given when asked for, nor a clear idea of the works proposed obtained, the proprietor, or his representative, having only in his mind the fact that £3 or £5 per acre was the limit of what he could claim. Invariably the full amount was applied for, even where

the works proposed did not justify expenditure to these amounts. The detailed estimate under heads provided for in the 1921–22 form of application had many advantages.

(5) There was generally misunderstanding as to what was meant by scrub, and this was frequently confused with the clearing of slash from felled areas. A clearer definition of scrub clearing would have saved much trouble.

Some proprietors anxious to reduce their unstocked acreage and without due consideration of the risks, put forward schemes for restocking immediately after felling operations. Against the advice of the divisional staff a number of such schemes were proceeded with resulting in a very heavy loss by weevil. A number of areas included in schemes suffered also considerable damage from rabbits through faulty protection. Much of this would have been avoided if more careful and frequent inspection could have been given by the divisional staff. Owing to the reduction in timber acreage during the War and on the score of economy, estate staffs have been very much reduced and the supervision provided for these schemes was sometimes quite inadequate. In any future forestry works which are State-aided it would be well to consider the capacity of estate supervision for administering such schemes in each case. The relief works already carried out have given the divisional staff an excellent opportunity for getting into touch with the woodland owners, and for assisting generally by way of advice, but the time available for advisory work is at present very limited.

In connection with the final settlement of schemes it has frequently been found necessary for inspecting officers to chain the area dealt with where a simple check ought to have been sufficient. The onus for stating the final claim should rest with the applicant and a satisfactory plan, based on measurements and prepared by him, should be insisted on. The keeping of pay sheets and accounting generally, in connection with the schemes, by applicants left much to be desired during the first season of these works, but this has been greatly improved by insisting that wages paid to unemployed be kept on the forms supplied from the divisional office.

F. Scott.

NURSERY STOCK-TAKING.

The following notes are supplied in accordance with the request of the Technical Commissioner and have special reference to the methods laid down in the Technical Instruction of June, 1923.

The methods described in the Instruction are in principle similar to those hitherto employed in the nurseries in the North-Eastern Division, Scotland. It is thought, however, that the count suggested is too intensive to be economically applied to large central nurseries as it involves the whole attention of the forester in charge and the whole time of the most skilled of his men for the greater part of the month of August. Much, however, depends on the evenness of the crop, in the case of an even crop it is thought that fewer counts would give equally

good results, but if the crops are irregular it is considered advisable that the counts should be carried out to the full extent laid down in the instruction.

Seed Beds.

(*a*) *Broadcasted Beds.*

Number of Sample Sections.—It is considered that in view of the time and expense incurred in taking a 5 per cent. and 10 per cent. count, half the number of counts, that is a count of say every alternate bed, would be sufficient where the beds are even.

The actual laying off of the 6 in. wide sample sections to be counted can be done either by fixing strings or wires across the bed at 6 inches apart, or preferably by the use of a frame. The frame at present in use is constructed of oak with fishing cord strings. This frame which has been made for beds 4 feet wide measures 4 feet by 1 foot inside and has two interior strings running the full length of the frame enclosing a strip 6 inches wide. It is considered that a metal frame in which the sides would be above the ground level would be an improvement as in the case of large plants the wooden sides are liable to bend down the plants. The iron frame would have the further advantage that the persons making the count could rest one hand on one of the bars instead of being tempted to support themselves by resting one hand on the ground among the young plants. A cross wire is used as a marker to indicate the centre of the bed and the plants on the strip enclosed 2 feet by 6 inches are counted from the alley.

Location.—It is suggested that a blind adherence to the instruction may in some cases lead to incorrect results, as especially in small areas of one kind, the sample sections might come in obviously good or bad patches. In such cases the selection of sample sections should be left to the judgment of the forester in charge rather than make an obviously incorrect count by adhering to purely mechanical selection.

Larch Seedlings.—Special care requires to be taken in the case of larch, which, particularly if it has been frosted, is liable to throw more than one leader and there is a danger in such cases of counting each leader as a separate plant. This applies more particularly to extra thick beds.

(*b*) *Drills and Bands.*

The method laid down in the Technical Instruction was found to be quite workable and ought to give good results. The actual counting of the plants can be facilitated by laying a wire or stick down across the drill after every 100 plants counted. This applies also to the counting of broadcast beds. This method is used by the Experimental Officer, Scotland, in making counts of experimental beds.

Transplants.

The method of counting laid down is that ordinarily employed in nurseries, but in the case of regular crops it is believed that a smaller proportion of counts than that laid down would give equally good results.

In the actual counting of the plants if a stick is inserted at every complete 100, a more reliable count can be obtained. If a proportion of the sticks are left in the ground the counts can be readily tested later if necessary. In the case of plants marked "Move." the suppressed plants which would be rejected as culls in August would in some seasons such as the past one put on sufficient growth to be included in the plants to "Move" instead of being rejected.

General.

No forester in charge of a nursery need expect, however accurate his count of one-year seedlings, that he can judge with any degree of accuracy what his out-turn of two-year seedlings or larger transplants will be. Even with an average of figures taken over a long period this is impossible as an average season probably never occurs for all species together, climatic conditions affecting different species in different ways. The various combinations of frost with its danger of frost-lift and destruction of leader, drought and excessive sun with the drying up of plants and excessive autumn moisture with its long drawn out growing season resulting in insufficient ripening of leaders exposing the plants to danger from frost and fungi cannot be foreseen.

These remarks apply though to a smaller extent in the case of older seedlings and transplants, and when it is realised that in the case of a 20-million lot of seedlings a discrepancy of only 5 per cent. results in a difference of one million plants it is evident that only conservative estimates should be made if the full out-turn is to be guaranteed.

This is a point on which there may be widely divergent views and it would be helpful if the opinions of officers in other divisions were broadcasted through the pages of the Journal.

If the count of the plants could be taken in the month of September instead of August more accuracy would be obtained as the growth would be more nearly completed. In the past season growth was late and very prolonged which resulted, *e.g.*, in beds of Sitka spruce, which in August were thought to be too small to move, afterwards growing so much that they should be transplanted this season. This remark also applies generally to transplants some of which were marked "Retain" in August but were large enough by the end of September to be marked "Optional" or in some cases "Move."

If the whole nursery count cannot be delayed until September it would be advantageous if the count of two-year seedlings could be delayed, as the allocation of seedlings is not made until some time after the arrangements for the distribution of transplants have been made.

J. F. Annand and J. W. Mackay.

FORESTRY AND THE IMPERIAL ECONOMIC CONFERENCE.

The memorandum which is printed below is of more than ordinary interest since it was prepared in connection with the first occasion

on which the subject of forestry has come before a Conference of statesmen of the Empire. It represents in fact the pass which secured the appearance of forestry on the stage of "high politics."

Taking the memorandum as his text, Lord Lovat addressed the Imperial Economic Conference on the subject of forestry, and in the discussion which followed the representatives of the Dominions, India and the Colonies, all acknowledged the great importance of systematic development and expressed their sympathy with the aims and objects expressed in the memorandum.

The following resolution was then adopted :—

> "The Imperial Economic Conference accepts generally the Resolutions of the Empire Forestry Conference (Canada, 1923) and recommends them to the respective Governments of the Empire for favourable consideration."

R. L. ROBINSON.

IMPERIAL ECONOMIC CONFERENCE.

FORESTRY.

MEMORANDUM BY THE FORESTRY COMMISSION.

1. In continuation of the introductory Memorandum* on forestry submitted in April last, the Forestry Commissioners beg to present the following Statement with reference to the recommendations of the Empire Forestry Conference which has been held in Canada in the interval.

2. The Conference was attended by representatives of Great Britain, India, all the Dominions and most of the important non-self-governing Colonies. Ample opportunities were afforded by the Canadian Federal and Provincial Governments for the inspection of Canadian forest resources and for discussion. The resolutions of the Conference explain in broad outline the work and findings of the Conference. It is proposed here to elaborate those subjects which are of general Empire interest, bringing to bear as well certain relevant information which the British representatives collected in a subsequent tour of the forests of the United States. These subjects are :—

(i) Forest Policy.

(ii) Softwood Resources.

(iii) Empire Trade in Forest Products.

(iv) Investigation into Forest Products.

(v) Forestry Education (Central Institution).

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* A brief note indicating the importance of the Empire's forests, the trade in forest products, the state of the forests, the proposals of the Empire Forestry Conference of 1920, and foreshadowing a further report on the 1923 Conference.

Forest Policy.

3. Industry requires as raw material ever-increasing quantities of forest products. The increase is due not only to growth of population, but also to the greater *per capita* consumption. Thus in the United Kingdom the amount of wood and timber used per head of population trebled during the sixty years before the war and was still increasing steadily. Coniferous timbers (or softwoods) are required for structural purposes and for pulp for paper; broad-leaved timbers (or hardwoods) for special purposes and to a minor extent for pulp; and, finally, miscellaneous products (Minor Forest Products), gums, resins, tannins, fibres, &c., for various purposes. Detailed figures for all these materials are not yet available, but the following figures indicate the magnitude of the current trade in timber, wood manufactures and pulp.

TRADE IN TIMBER, WOOD MANUFACTURES AND PULP OF WOOD, 1922.

	Imports.		Exports (including Re-exports).	
	From Empire Sources.	From Foreign Sources.	To Empire Destinations.	To Foreign Destinations.
	£	£	£	£
United Kingdom ...	6,523,000	43,145,000	1,234,000	1,375,000
Canada	102,000	3,524,000	3,969,000	21,439,000
Commonwealth of Australia	1,070,000	1,920,000	1,246,000	72,000
New Zealand	590,000	123,000	484,000	1,000
Union of South Africa ...	793,000	1,439,000	23,000	29,000
Newfoundland	18,000	9,000	121,000	2,000
India	830,000	864,000	411,000	161,000
Colonies and Protectorates*	456,000	1,052,000	361,000	439,000
	10,382,000	52,076,000	7,849,000	23,518,000
	62,458,000		31,367,000	

* Exclusive of British Guiana, British Honduras and certain of the smaller Colonies for which no recent information is available.

It will be observed that 83 per cent. of the Imports were from foreign sources and 75 per cent. of the Exports to foreign destinations.

In 1922 Empire imports of the most important Minor Forest Products amounted to approximately £8,000,000 and exports to £11,000,000.

4. It is a matter of elementary prudence for every country which is developing on the lines of Western civilisation to ensure that materials of first-rate importance to industry shall be readily available at all times. The aim of Forest Policy is to ensure continuity of supplies on a scale sufficient to meet prospective demands. Resolution No. 1

of the Forestry Conference reaffirms what may be called the fundamental creed of foresters.

The Commissioners believe that the future well-being of the whole Empire and its individual parts depends in no small measure on the effective incorporation of this creed into accepted political economy, and they recommend it to the Imperial Economic Conference in that sense.

Softwood Supplies.

5. Of the total quantity of wood and timber used in the trade and commerce of the World probably at least 80 per cent. is softwood.

The great softwood forests are situated in the Northern Hemisphere, in Europe, Siberia and in North America. In round figures Europe is estimated to have 240 million acres of *merchantable* softwood forests; the area in Siberia is unknown, but the major portion is very difficult of acess and unlikely to be of commercial value in the near future; the United States has 225 million acres (exclusive of Alaska), and Canada 234 million acres. Outside of Canada the Empire contains no large body of softwoods, which is surplus to present—to say nothing of prospective—requirements. As regards the Empire the main lines of export of forest produce from the northern softwood forests are as follows: From Northern Europe to Britain, South Africa, Australia and India; from Eastern Canada to the United States and Britain; from the Southern United States to Britain, and from Western Canada to the Orient, India and Australia, to the United States and Britain.

6. The position as regards permanence of supplies from these softwood regions is far from satisfactory. As regards the European exporting countries, in Sweden and Finland only is the annual growth equal to the annual cut. Little authentic information is available with regard to the great northern Russian softwood forests which cover some 210,000,000 acres. The merchantable area is roughly 40,000,000 acres, but it is believed that the pre-war cut exceeded considerably the growth. The withdrawal of so large a body of timber from Commerce emphasises the importance of every country maintaining reserves of its own.

In the North American softwood forests the inroads by felling, fire and insects are very great; in the Canadian forests at the best they balance the growth, while in the United States it is estimated that they are 4·8 times as great for all classes of softwoods and 8·6 times as great for saw-timber. The position of the United States is in fact of supreme importance in considering this question of the Empire's softwoods supply.

Starting with 820,000,000 acres of softwood and hardwood forest the United States have now approximately 470,000,000 acres of nominal forest. Of the latter area 138,000,000 acres are virgin forest, 250,000,000 acres are second growth, of which a very small proportion only is cared for systematically, and upwards of 81,000,000 acres are so devastated as to produce nothing until replanted. The great industries of the States are mainly in the east and the Atlantic forests have been depleted

to meet their requirements. The procedure has been to work out one forest region and then to turn to the next most convenient region. The new region is attacked first on a small scale, the large export mill follows, production reaches its peak in a few years, remains steady for a few years more and then falls rapidly. After a small mill has completed the cleaning up process, production is practically at an end and sometimes insufficient for local requirements. First the New England and then the Lake State Forests were worked out. In ten to fifteen years the Southern Forests, which now supply rather more than one-third of the total consumption of United States softwood timber will have reached the same stage of depletion. Lumber is now being transported by rail 2,750 miles from the Pacific Forests and 1,200 miles from the Southern Forests to the Eastern manufacturing centres.

This systematic depletion of the forests of the Eastern United States has been met by the increasing importation of forest products from Canada. The table below shows how the United States have displaced the United Kingdom in the Canadian export market.

AVERAGE ANNUAL EXPORTS OF WOOD, WOOD PRODUCTS AND PAPER FROM CANADA.

Values ($) in 1,000's.

Destination.	2 years, 1891–92.	5 years, 1893–97.	5 years, 1898–1902.	4¾ years, 1903–07.	5 years, 1908–12.	5 years, 1913–17.	5 years, 1918–22.
United Kingdom ...	10,703	12,410	13,505	16,744	13,411	14,542	22,538
United States of America	12,265	14,388	11,012	21,916	33,807	54,697	149,137
Other countries ...	1,417	1,679	1,952	4,313	5,957	5,754	18,196
Total	24,385	28,477	26,469	42,973	53,175	74,993	189,871

Well-informed American opinion views the position with misgiving and anticipates that it may be necessary for the United States in due course to come into the European market for timber as they have already done to a small degree for pulp.

Such briefly are the grounds on which the Forestry Conference was led to pass the Resolution No. 2 that it was incumbent on every part of the Empire to conserve and augment its own resources of growing coniferous timber.

Hardwoods and Minor Forest Products.

7. *Hardwoods.*—The position differs materially from the softwood position. At present the demand is relatively small while the Empire possesses in its tropical and sub-tropical parts, huge resources for which no adequate uses have yet been found. There are, however, distinct signs of a change. The United States are using up their hardwoods at 3½ times the rate of growth, there is an increasing tendency in certain districts to use hardwood sleepers in place of pine. The Madi-

son Forest Products Laboratory is impressed with the situation and is turning its attention to the examination of tropical woods.

It is only reasonable to conclude that with the depletion of the softwoods and the better class temperate hardwoods, more and more recourse will be had to tropical woods, both because of their intrinsic merits and as substitutes for softwoods. There is undoubtedly within the Empire a large field awaiting development, but a considerable amount of systematic pioneer work is required first in taking stock of resources, and secondly in testing and bringing into commercial use timbers which are at present little known. The two should obviously proceed hand in hand.

Minor Forest Products.

So far as is known there is no special anxiety as to the future supply of the very numerous articles of commerce falling into this category. On the other hand British industries have shown a remarkable capacity to absorb new materials with distinctive properties, such as rubber, copra and palm oil, which were originally minor forest products.

The evidence produced at the Forestry Conference was to the effect that there was considerable room for development in the production of minor forest products, and it was agreed that the subject should be especially considered at the next Conference.

Empire Trade.

8. *Softwoods.*—As regards the trade in softwoods it does not appear that the main currents can be so deflected that the Empire can be made self-supporting. The indications rather are that one of them, the Canadian-United States current, is likely to increase until in due course there remains practically no surplus for export from North America. This statement is made on the basis of the present trend of development, which may be worth explaining in further detail.

As pointed out already in paragraph 6 the depletion of the forests of the Eastern States has rendered it necessary for the industries to seek fresh sources of supply, which the Eastern Canadian forests by reason of their accessibility have naturally provided. As regards timber the American consumer is less fastidious than the British, being content to buy 15/16 inch boarding as inch and to accept more defective material. A large proportion of the output of the saw-mills is of small dimensions, suitable chiefly for house building, and does not find so ready a market in Britain. As regards pulp-wood the United States pulp mills have found it desirable to import round about 1,000,000 cords in order to keep going or to conserve their own inadequate resources in growing wood. As regards pulp and paper, Canada exported in 1922 approximately 1,200,000 tons to the United States. These processes have resulted in the influx of American capital into the Canadian forests and with it a close understanding of trade requirements.

So much for the present trend of development : if on the other hand Canada could devote to systematic timber production the enormous area of land suited to nothing else, she could produce sufficient

soft woods to meet not only the needs of the markets of the United States, but also the normal requirements of the Empire markets.

In spite of the permanent character of the main trade currents a number of examples were quoted at the Forestry Conference showing that with a better system of Trade Intelligence an increase in the Empire Trade in softwoods might be secured. For example, fruit is carried from the West Indies and from South Africa to Canada in Swedish boxes; timber is imported by Japan from British Columbia to be sawn up and re-exported as boxes to the Malay States; Douglas fir timber similar to that growing in British Columbia is imported into Australia from Washington and Oregon.

Hardwoods and Minor Forest Products.—As regards hardwoods and minor forest products the markets to a considerable extent have yet to be developed. This subject is dealt with below under the heading "Forest Products Investigation."

PROPOSALS FOR ACTION.

9. The Commissioners, on behalf of the Forestry Conference, venture to bring to the notice of the Imperial Economic Conference Resolutions Nos. 1 and 2 of the Forestry Conference, dealing respectively with Forest Policy and Softwood Resources and to suggest that both are of such importance as to warrant the attention and support of the Imperial Economic Conference.

Action in respect of both resolutions would then rest with the individual Governments of the Empire.

They have also the honour to submit the following proposals which call for co-operative action:—

(*a*) A systematic survey of the Forest Resources of the Empire.
(*b*) Forest Products Investigation.
(*c*) An improved system of Commercial Intelligence.
(*d*) An Empire Forestry Bureau.
(*e*) A Central Training Institution (Forestry) at Oxford University.

Certain of these proposals, viz., the Survey of Resources, Forest Products Investigation and the Training Institute are purely forestry questions; those relating to Commercial Intelligence and the Forestry Bureau are involved in wider questions which are already before the Economic Conference.

10. *Survey of Resources.*—Most of the Delegates to the Forestry Conference were able to report that under the stimulus of the first Empire Forestry Conference (1920) a beginning is being made with this work, but it is desired to emphasise the importance of accelerating progress and of aligning the results of the survey with the investigations to be conducted at the Forest Products Laboratories of the Empire.

11. *Investigations into Forest Products.*—It is clear that a great deal more attention could be paid with advantage to those great forest resources which have either remained undeveloped or imperfectly utilised. It is a problem which is common to all parts of the Empire and calls for concerted as well as individual action.

The Forestry Conference, in discussing this question, had before them reports on the work being done in Great Britain, Canada, India

(Dehra Dun), Australia, South Africa and other parts of the Empire and in the United States. There was complete unanimity in the view that the lead set by the United States of concentrating investigations at a Forest Products Laboratory was sound, and Resolution No. 7 emphasised the necessity of setting up such a laboratory for Great Britain and those non-self-governing parts of the Empire which have no laboratories of their own.

Subsequently, Lord Lovat and other delegates to the Conference visited the United States laboratory at Madison and were able to confirm at first hand the wisdom of the resolution. The Madison Laboratory is probably one of the most successful of its kind in the world, and owes its success to the following among other reasons :

(*a*) That it is under the direct charge of a responsible officer who has been given a reasonably free hand to concentrate on the work.

(*b*) That the laboratory has gathered up, co-ordinated and expanded the scattered work already in progress.

In the words of Colonel Graves, late Head of the United States Forest Service, " We made no progress until we got the work under one roof and organised it."

(*c*) While keeping fundamental research well in the foreground it has reached out into the commercial world inspiring it with the value of investigational methods and learning in return the nature of the problems with which the industry was confronted. In this way the confidence (and gradually the financial help) of commercial men has been obtained.

The experiences, so far as they go, of the existing Empire Laboratories are confirmatory.

The setting up of the laboratory in the first instance is a matter for co-operation between the Colonial Office as representing the non-self-governing parts of the Empire, the Department of Scientific and Industrial Research and the Forestry Commissioners. But the proposed laboratory ought to render wider Empire services than those connected with home and colonial forest produce. By co-ordinating its operations with those of the laboratories at Montreal, Dehra Dun and elsewhere it should be possible to cover the whole field of work very effectively, to secure uniformity in methods and to prevent overlapping. By this means a very desirable stimulus could be given to the more systematic investigation and utilisation of our very valuable forest resources.

12. *Commercial Intelligence and the Empire Forestry Bureau.*— The Commissioners observe that the subject of Commercial Intelligence is before the Economic Conference, and they have, therefore, no comments to make except that the subject of Forest Products should receive adequate attention in the scheme which will doubtless be evolved, and that it will be necessary for the proposed Forest Products Laboratory to be kept in the closest possible touch with the Forest Products side of the work of the Commercial Intelligence organisation.

The proposal to form an Empire Forestry Bureau originated at the First Empire Forestry Conference (1920) and was reconsidered at the Second Conference (1923). The recent proposals with regard to the reorganisation of the Imperial Institute (I.E.C. (23)–13), were not then known, and the Second Forestry Conference considered it advisable, in view of the current financial stringency, to distribute the work of the Bureau, so far as was possible, between the Empire Forestry Association and a Standing Committee (Resolutions 5 and 6).

The paper submitted by the Department of Scientific and Industrial Research (I.E.C. (23)–16, paragraph 35) points out that a place should the reserved for the Forestry Bureau in the reorganised Imperial Institute and the Commissioners would support that proposal.

13. *Central Training Institute.*—The development of technical Education and Research in Forest matters has not kept pace with requirements. There has been a dispersal of effort with the result that at no place in the Empire is it possible adequately to train technical officers and research workers. This is a serious hindrance to forest development and was emphasised in Resolution No. 4 of the Forestry Conference. The debates on the subject showed clearly the desire of overseas forest officers to have in close proximity to the Continent of Europe a centre from which to study the result of the old-established systems of silviculture and methods of research.

The proposal to set up forthwith at Oxford a Central Institution for post-graduate training and research is founded partly on that need, but it is hoped that in due course other parts of the Empire will establish similar institutions for the development of special subjects : Canada, for example, for forest engineering ; India for tropical forestry. The main cost of the Institution will fall in the first instance on the Forestry Commission and the Colonial Governments, but it is believed that the Dominion Governments and the Government of India may find it of practical value and worthy of some measure of financial support.

FORESTRY COMMISSION,
22, *Grosvenor Gardens, London,*
October, 1923.

BRITISH EMPIRE FORESTRY CONFERENCE.
(CANADA, 1923.)

Great Britain was represented at the Conference by Lord Lovat, Mr. Robinson, Drs. Borthwick and Munro, Mr. Fraser Story, Professor Troup (Oxford), and Sir James Calder. Colonel Courthope represented the Empire Forestry Association.

The Proceedings of the Conference are in course of preparation by the Dominion Forestry Branch, and will be circulated to technical officers in due course. The " Summary Report and Resolutions of the Conference " have already been circulated.

The work of the Conference was presented to the Imperial Economic Conference which met in London last autumn, and was very favourably received by that body. (*See* pp. 14–22.)

Besides attending the Conference the Commission's representatives took the opportunity of obtaining further first-hand knowledge of forest conditions in North America. Lord Lovat and Mr. Robinson visited the State of Washington ; Lord Lovat and Professor Troup the Forest Products Laboratory at Madison ; Mr. Robinson proceeded down the West Coast to San Francisco, and into the Sierra Nevadas ; Dr. Borthwick took the Queen Charlotte Islands and the northern parts of British Columbia ; Mr. Fraser Story went south from Winnipeg, and visited the Lake States, New England and the Southern States. Finally Lord Lovat, Mr. Robinson and Mr. Fraser Story met in Washington City, and spent some days looking into the organisation and working of the headquarters of the United States Forest Service.

R. L. ROBINSON.

NOTES ON NORTH AMERICAN FORESTS.

For lack of space it has been necessary to make the following notes as to forest types and species very brief. The reader who wishes to know more of this subject should consult the literature in the Commission's library.

THE EASTERN FORESTS OF CANADA.

The Eastern Coniferous Forests of Canada have been badly devastated in the accessible parts by lumbering, fires, and the spruce bud worm. Lumbering has passed through two stages, and is now in the third ; first, the cutting out of the large white pine (*P. strobus*) ; second, of large white spruce (*Picea Canadensis*), both for manufacture into timber ; and third, the utilisation of smaller white spruce, balsam fir (*Abies balsamea*) and black spruce (*Picea nigra*) for pulpwood. Each cutting has been accompanied by large scale fires, apart from the perennial fires arising from settlers and campers. The burnt areas come up in poplars or jack pine (*P. Banksiana*), and white pine frequently occurs as an understory with the poplars. Generally natural regeneration is prolific, and if cuttings were properly regulated and fire kept out the silviculture of the coniferous forests should not be particularly difficult.

The Conference visited one of the more inaccessible areas which has not yet been exploited, viz., Timagami Forest Reserve (Ontario), where there are some magnificent stands of virgin white pine and red pine (*P. resinosa*). The latter bears a close resemblance (superficially at least) to the Corsican pine.

The Eastern Hardwood Forests have largely disappeared to make way for agriculture. Scattered remnants of maple remain as farmers' woodlots.

Apart from the Weymouth (white) pine none of the eastern species do well in this country. Possibly the black spruce which is a swamp-living tree might be made use of in very poor sites. It grows extremely slowly, and does not reach a large size.

The Prairies and Northern Forests.

The Prairies except for occasional poplar bluffs and artificial plantations (shelter belts) are treeless. North of the prairies there is a belt of forest 300–400 miles wide, consisting of white and black spruce, jack pine and aspen (after fire).

The Western Forests.

The Rocky Mountains (Canada).—The chief species are the Engelmann spruce and the lodgepole pine (*P. Murrayana*), passing into Alpine fir (*A. lasiocarpa*) at higher elevations. A great deal of damage has been done by fire, and on burnt areas lodgepole pine comes in. It is possible that this species, or its *contorta* form, may be of considerable use on poor exposed sites in Britain, and a supply of seed is being obtained. Douglas fir extends eastwards as far as the Rocky Mountains.

West of the Canadian Rockies are three fairly well marked belts, viz.: the Interior Wet, the Dry, and the Coast Belts. The number of forest types is large, but the essential features from our point of view are as follow :—

The Interior Wet Belt is practically similar to the Coast Belt.

The Dry Belt.—The predominating species is the yellow pine (*P. ponderosa*), pure in the drier parts, but with an increasing proportion of Douglas fir as the rainfall increases.

The Coast Belt.—Douglas fir, red cedar (*Thuja plicata*) and western hemlock (*Tsuga albertiana*) are the chief trees with Sitka spruce, *Abies grandis* and western white pine (*P. monticola*) as subsidiary species. These trees are rarely found pure, but combine to form a number of types dependent on moisture and temperate conditions. All the trees grow to very great sizes under optimum conditions. Douglas does best with a rainfall of 50–60 inches, cedar and hemlock on wet sites with 90–100 inches, Sitka best in the Queen Charlotte Islands. (*See* Dr. Borthwick's notes.)

The Western Forests of the United States.

The States of Oregon, Washington, Idaho, Montana and California contain over half the remaining saw-timber in the United States. They already provide the raw material for over one-third of the timber industry, and are rapidly increasing in importance as the supplies of standing timber in the Eastern States are depleted. In this region are situated all, except one, of the National forests extending to 150 million acres. The conditions of growth are very varied, and range from very humid along certain sections of the coast to arid desert in the interior, and from semi-tropical in the south to alpine in the mountains. There is a profusion of coniferous species, most of which grow in the arboretum in Great Britain. Among the more interesting features to the British silviculturist are the following :—

The coast forests of Washington and Oregon are an extension on a large scale of the coast forests (Douglas fir, etc.) of British Columbia. These forests have been heavily cut to supply the world with Oregon pine

and lumbering is now receding into the mountains. The coast type forests do not cross the Cascade Mountains, but are replaced generally by yellow pine, as in the Dry Belt of British Columbia.

The Redwood Belt (*Sequoia sempervirens*) extends for some 200 miles along the foggy coast of North California, and is some 30–35 miles wide. At Fort Bragg the soil is a loam not unlike that produced from our Silurian Shales, the range of elevation is sea-level to 1,600 feet, and the topography generally not unlike our Welsh hills. The redwood, which is associated with Douglas fir and *Abies grandis*, grows 300 feet high (I walked for 100 yards along a felled tree selected at random), and 15 feet diameter. Stands of 40 to 50,000 cubic feet per acre are probably quite common. The redwood sprouts from the stump in a most amazing way. The sprouts grow with great vigour, and may apparently be relied on to regenerate the forest.

The forests of the Sierra Nevadas are approached from the west by way of arid foothills, on which scrub oak and digger pine (*P. Sabiniana*) gradually give way to yellow pine forests at about 3,000 feet. Other species creep in as the moister conditions improve with increasing elevation, among them various silver firs (*Abies magnifica* and *concolor*), *Libocedrus decurrens*, *Pinus Jeffryi* and the Sugar pine (*P. Lambertiana*), and the Big Tree (*Sequoia* (*Wellingtonia*) *gigantea*). They all, with the possible exception of *Libocedrus*, grow into trees of exceptional dimensions, but nevertheless are completely dwarfed by *S. gigantea*. This tree grows in isolated groves (the Mariposa Grove is a couple of hundred acres or so in extent), in association with sugar pine, *A. concolor* and other species. Many of the giants have been named after famous Americans—General Sherman is 286 feet high and 36 feet in diameter at the base. Over 4,000 annual rings have been counted on a few felled trees.

Douglas Fir.

Apart from the two varieties hitherto recognised in this country, viz., the Oregon, green or coast variety and the Colorado, blue or mountain variety, there are certainly a number of types which can be correlated with environment. The only place where I encountered the blue Douglas was on the precipitous slopes of the Grand Canyon of the Colorado River in Arizona (6,500 feet elevation). The mountain type in the Canadian Rockies is certainly not the blue Douglas, but a rather stiff growing and glaucous type allied to the coastal variety. The Dry Belt of British Columbia has a fairly distinct type which is apparently that called *caesia*. The Commission received a quantity of seed in 1921 from De Hurst (Identification No. 21/17) which is probably Dry Belt Douglas. The plants resulting from this seed have grown very slowly in the nursery. The Coastal type was not as green as I had expected to find it and in fact it was only locally on Vancouver Island that I saw the typically luxurious growth with lammas shoots.

Generally I confirmed my impression, gradually arrived at from observation in this country, that Douglas is a hardier and more adaptable species than British silviculturists believe. It grows best

in sheltered sites on well drained soils with heavy rainfall (over 40 inches) humid atmosphere and moderate temperature ranges, but it is still a noteworthy tree under what appear to be unsatisfactory conditions. As regards wind, the species shows comparatively little sign of damage on the numerous rocky islets between Vancouver and Vancouver Island, yet the wind pressure must be severe. The tree comes right down to the water's edge, well within reach of salt spray. On the coastal plain magnificent Douglas grow on sandy and gravelly soils of a hungry appearance. In the Dry Belt the tree exists with an annual rainfall as low as 11 inches. In the Cascade Mountains I found young trees (planted three years) quite happy at the end of a long dry summer which had completely desiccated the top six inches of soil.

I saw only two Douglas fir nurseries. In that at Wind River (Columbia National Forest) the procedure is to sow in the autumn (the beds are snow-covered in winter), line out as one-year seedlings and plant as one-year-one. The one-year seedlings were perhaps a little better than our average but not so good as our best. The second nursery was at Fort Bragg on the Redwood Belt towards the southern limit of Douglas, and I liked the look of the nursery stock best of any young plants I had seen.

Douglas regenerates itself well, often after severe fires. American foresters attribute this to the storage of seed over considerable periods in the thick duff (dry humus) of the old forest. In good seed years the seed is carried well down by rodents and then forgotten. The fire rarely burns the duff completely and does not destroy the seed in the lower layers. The theory struck me as somewhat fantastic to begin with, but after seeing the extensive burns in the Columbia Forest, where two to three hundred thousand acres were burned by one fire, I believe there is something in it.

R. L. Robinson.

FORESTS OF THE EASTERN UNITED STATES.

After attending the Empire Forestry Conference in Ottawa, I had an opportunity of seeing something of the forests of the eastern half of the United States. Entering the States from Manitoba, I travelled down the full length of the Mississippi Valley to the Gulf of Mexico, cut across to Florida from New Orleans, took in the hardwood region of the Alleghanies on my way north, inspected some of the woodlands of New England in Connecticut and re-entered Canada near the mouth of the St. Lawrence River. My tour enabled me to sample the principal forest regions of a wide expanse of country, and some of the impressions received may be recorded, although they are merely personal observations with all the defects that attach to a rapid survey.

In the Lake States of Minnesota and Wisconsin, I found little else but desolation—for how otherwise can one describe the thousands of acres of cut-over and burned-over lands previously occupied by white pine, red pine and eastern hemlock, which now bear an unprofitable,

weedlike growth of aspen and birch. The history of this region is the common one of destruction by lumbermen, followed by repeated fires and neglect.

Thanks to the good services of American foresters I was able to travel hundreds of miles by motor car through a district previously famous for its white pine forests, but I seldom saw even isolated specimens of that species although now and again I came across areas where the red pine *P. resinosa* and *P. Banksiana* were restocking the ground —showing what was possible given reasonable care. For the most part the forest lands have been stripped of all that is saleable. Fire follows in the wake of the exploiter because under existing conditions this is practically inevitable. Not merely ordinary lop and top are left behind on the completion of logging operations, but in natural forests there is so much rejected material in the form of dead and dying trees, in addition to timber considered unfit for removal, that a fire once started soon gets a remarkably firm hold and nothing will stop it. If an area is burned over only once regeneration gets a chance, but when it is burned several times, as is generally the case, the soil suffers and the destruction of seed trees completes the ruin. Under such circumstances restocking is possible only by the agency of coppice shoots of hardy species and by means of the lightest seeds which blow on to the areas from a distance.

In the Lake States night frosts occur even in summer. There were several degrees of frost at the time of my visit in August. These frosts combined with the long, severe winters naturally limit the number of species which may be grown.

The broad-leaved trees most typical of the region are sugar maple (*Acer saccharum* Marsh.), yellow birch (*Betula lutea* Michx.), paper birch (*B. papyrifera* Marsh.) and the aspens (*Populus tremuloides* Michx. and *P. grandidentata* Michx.). Beech is not found in the western part of the Lake States but occurs in the east; red maple (*Acer rubrum* L.), owing to its small size, is of little economic value; *Ostrya virginiana* Koch. also is unimportant, although abundant. These with American elm (*Ulmus americana* L.) and lime (*Tilia americana* L.) practically complete the list.

The conifers are restricted to those which I have already mentioned with the addition in some places of jack pine (*Pinus Banksiana*) white and black spruces and tamarack (*Larix laricina* Koch).

Of the many causes of the sudden and more or less complete deforestation of the Lake States, one can mention here only a few. The fact that about 80 per cent. of the land belongs to private owners accounts for a good deal; the generally level or undulating character of the land lends itself to easy exploitation, especially as lakes and rivers further facilitate timber transport; the great industrial development of the last 30 to 40 years has also no doubt largely contributed. In New England and New York the sawmill industry had to be built up gradually, but in the Lake States lumbering descended fully developed, equipped with every modern contrivance for rapid achievement. Large mills, mechanical appliances of every kind and a ready market for the produce soon wrought the havoc which one sees to-day. It

is estimated that in this district alone (Michigan, Minnesota and Wisconsin), the area of cut-over lands is no less than 25 million acres.

The conditions briefly indicated above were those which I encountered near the headwaters of the Mississippi. At the mouth of the same river, I found a similar state of affairs, the main difference being that operations there are still in full swing, and, of course, the species are entirely different. The systematic destruction of the forest is the same. Having virtually exhausted the softwood resources of the north and east, lumbermen turned their attention to the south; being nearly through with that, the movement now is to the west where the last great stand of American forest is to be found.

At the mouth of the Mississippi one is down among the cypress swamps, the bottom lands bearing Nyssa, Liquidambar and Magnolia and these I should have liked to have investigated, but with limited time at my disposal I had more or less to concentrate on the sandy plains where the pines occur.

The southern group of States at present cut more timber than even the Pacific group although they have passed their maximum production; now that four-fifths of the virgin forest is gone the rate of exploitation obviously cannot increase much further. The principal southern pines of commerce are the longleaf pine (*Pinus palustris* Mill.), loblolly pine (*Pinus taeda* L.), shortleaf pine (*P. echinata* Mill.) and slash pine (*P. caribaea* Morelet). All are "hard" pines and all have their needles in clusters of three.

The timber of *P. palustris* (the "pitch pine" of commerce) is superior to that of all other pines in strength and hardness. Loblolly timber takes second place and is often mixed with *P. palustris* as the two enter the mills together and are almost indistinguishable, although in the case of timber from younger trees the loblolly is decidedly softer and coarser.

In this district I inspected the forest property and saw-mills of the Great Southern Lumber Company. The company owns 150,000 acres of virgin forest in Louisiana and also considerable areas in the State of Mississippi. As the company clears on an average 60 acres of fully stocked pine forest per day, cutting continuously summer and winter, some 18,000 acres per annum are required to keep the mill going. The plant is said to be the largest of its kind in the world and has an output of a million board feet of timber every day. The company makes no secret of its policy which is to continue rapid exploitation as long as the forests last. When the end comes which may be 20 or 25 years hence, they will scrap the saw-mill plant and turn to the production of wood-pulp from second-growth forests.

For this company it may be said that they have at least some regard to the future, but in this respect it is exceptional for in very few cases is attention paid to re-stocking felled areas—estimated in the southern States at between 2 and 3 million acres per annum. The result of the general attack upon the southern forests is that these have shrunk from an original area of 250 million acres to about 31 million acres—the extent of the forest to-day.

From an examination of statistics and conversation with owners and managers of mills, foresters and those in control of the home and export timber trade, it would appear that the manufacture of pitch pine on a large scale will not last more than 14 or 15 years : after that, small mills will still be able to operate but there will be a great reduction in the quantity produced.

Proceeding to Florida I found that all the forests of economic importance are situated in the north of that State. Many of the woods are poorly stocked because their owners prefer to deal with them as sources of turpentine production, and for resin-tapping sparse woods are more suitable ; in a great many cases comparatively little importance is attached to the timber itself. A considerable part of the peninsula of Florida is sub-tropical and bears very little ordinary forest vegetation, the land being given over more to palms, orange groves, etc., than to timber production. According to Colonel W. B. Greeley some 13 million boxes are used annually in marketing Florida's citrus crop. As each box requires for its manufacture about 5½ board feet of timber it is evident that the local demand for the commodity is considerable.

I experienced a further change of scene and of forestry conditions on reaching the Blue Ridge Mountains in North Carolina. Here are situated the highest peaks of the Appalachian system and occurring roughly mid-way between the Gulf of Mexico and the Lake States the district is particularly interesting from the point of view of the distribution of species. It is the meeting ground of the northern and southern forest types. At elevations over 5,000 feet one might almost imagine oneself in Canada. There is the yellow birch, sugar maple, eastern hemlock, red spruce, a balsam fir (*Abies fraseri* Poir) sassafras and cherry, just as in the north.

On hillsides of slightly lower elevation the spruce does not occur even where the site is moist, but in place of it linden, white ash, red oak and chestnut (*Castanea dentata* Borkh) are found. On dry slopes and ridges where fires have been particularly destructive the principal species are chestnut, chestnut oak (*Quercus montana* Willd), scarlet oak, pitch pine (*Pinus rigida* Mill.) and acacia (*Robinia pseudacacia* L.).

Lower moist situations are occupied by tulip tree (*Liriodendron tulipifera* L.), chestnut, red oak (*Quercus rubra* L.), white oak (*Quercus alba* L.), a small proportion of white pine, hickory, cucumber (*Magnolia acuminata* L.), white ash, walnut and western plane.

One cannot mention all the trees occurring indigenously in this district but each of the following is important in its way : southern jack pine (*Pinus virginiana* Mill.), Table Mountain pine (*Pinus pungens* Lambert), Carolina hemlock (*Tsuga caroliniana* Engelm.), deciduous cypress (*Taxodium districhum* Rich.), Pencil cedar (*Juniperus virginiana* L.), white walnut (*Juglans cinerea* L.), Carolina poplar (*Populus deltoides* Marsh.), river birch (*Betula nigra* L.), numerous species of oak and elm, black cherry (*Prunus serotina* Ehr.), honey locust (*Gleditsia triacanthos* L.), and persimmon (*Diopyros virginiana* L.).

In area, volume and value, broadleaved trees greatly predominate in the Appalachian region. Along with the deciduous forests of the lower Mississippi they form much the most important reserve of hard-

woods in North America. All the forests which I saw, however, had been severely culled. The best timber has been taken and the more accessible areas have been cleared. Chestnut is the most abundant species forming about 50 per cent. of the stand, and if it succumbs to the chestnut blight (*Endothia parasitica*) further enormous injury will be done to the forests. This bark disease has exterminated the chestnut throughout New England and the Eastern States and is working its way south.

I completed my tour by visiting Connecticut and seeing something of the other north-eastern States in passing through. New England in a forestry sense is divisible into two parts—the north adjoining Canada where the spruce-balsam fir association with some admixture of broad-leaved trees prevails and the south where the birch-beech-maple-hemlock type predominates. New England has been so completely cleared that over 95 per cent. of present exploitation is from second-growth timber. Any little original forest still remaining is in the north-east, and, as in Canada, spruce budworm and fungus pests have done a great deal of damage within recent years. The white pine forests, so valuable at one time, have practically disappeared. During the past 20 or 30 years there has been great development of the pulp industry, but nowadays a large and ever-increasing proportion of the raw material is drawn from Canadian forests.

To sum up very briefly, what impressed me most of all in the United States was the amount of forest destroyed without any thought of its replacement. The American Forest Service is fully alive to the danger of over-exploitation and waste, but the public does not seem to care what happens. The people of European countries would be shocked beyond measure to see such devastation but Americans have allowed it to go on almost without protest. Whatever may be the cause, the results are deplorable. Over seven million acres of forest land are burned over annually; the extent of land deforested is already nearly three times as large as the remaining virgin forest: an area greater than the whole of Great Britain and Ireland has been so mal-treated that no hope is entertained of restocking it by natural means: timber consumption is four times greater than the annual forest growth.

Apparently there is timber to carry on with for the next 25 years or so, but the original forests will then be exhausted. To eke out supplies Canada will no doubt be drawn upon to an increasing extent and the second-growth forest of the States will be ransacked without yielding very much. Possibly the pulp-wood situation will be eased somewhat by the use of supplies from Alaska and by the manufacture of pulp from the wood of broad-leaved trees by improved chemical processes. If not, forest depletion will gather momentum with the years. In any case, the American demand for Canadian timber will seriously reduce softwood supplies that otherwise would be available for Great Britain and the British Colonies.

FRASER STORY.

SEED SUPPLY FROM BRITISH COLUMBIA.

When the Forestry Commission started nursery operations on a large scale, it was clearly seen that the source of seed supply was a matter of fundamental importance. Scots pine could be obtained from home resources, while the best sources on the Continent from which reliable spruce and larch seed could be expected were investigated.

The question of Sitka spruce and Douglas fir was solved by the friendly co-operation of the Forestry Branch of the Department of the Interior, Canada. The Dominion Government controls that part of the Lower Fraser River Valley where Douglas fir of good type and quality exists. This species also occurs in equally good stands along the Coastal regions of British Columbia and on the Island of Vancouver, but apart from the "Railway belt," a tract extending to 20 miles on each side of the C.P.R., which runs through the Fraser Valley, the forests of British Columbia are under the control and management of the Provincial Forestry Department and this includes the Queen Charlotte Islands, where the Sitka spruce of the finest type for British forests occurs, and the valuable co-operation of the Provincial Forestry Department has also now been obtained in arranging for and supervising the collection of seed from trees of the best quality.

The Dominion Government erected a seed extracting plant at New Westminster. This is a three-storied wooden building. The ground floor accommodates the extraction apparatus and furnace. The original extracting device was in the form of a large perforated revolving cylinder enclosed in a zinc casing. The cones were fed in through a chute from an upper floor while through a wide tube from the furnace, hot air was driven in to dry the cones, the temperature being kept at 120° Fah. A series of troughs were arranged below the drum to catch the seed. The winged seed was then transferred to a zinc box with a circular or rounded interior in which a paddle wheel-like arrangement, with brushes on the blades, was made to revolve, in order to free the seed from the wings. From this receptacle the seed was then put through a winnower to remove the chaff.

It was, however, found in practice that the revolving hot air drum was not effective. The cones did not open properly and by prolonged rubbing in the cylinder they became ground to a mealy powder. The present method is to place the cones in wooden trays on racks, in the top story to which they are raised by an electric lift. The trays are 3 ft. long, 2 ft. broad and 4-in. in depth. This heated loft holds the contents of 80 sacks, each sack contains about 3 trays of cones. After opening in the loft, the cones are shot down into the revolving drum, not now heated, and the motion of the drum shakes the seed out. This method is found to work satisfactorily.

The two main species dealt with are Douglas fir and Sitka spruce which come from the Lower Fraser Valley and the Queen Charlotte Islands respectively. Tsuga Albertiana, Thuya gigantea, Abies grandis and Pinus Murrayana were also being dealt with this year. The Queen Charlotte Islands form a group lying between 131° and 133° latitude and 52° and 54° longitude. The two main islands are Moresby

Island in the south and Graham Island in the north. The ground in general rises more or less abruptly from the shore. Each island is under the charge of a forest manager. On both islands the forest may be divided into three zones. The first a fairly narrow belt along the shore line, the second zone varies in depth according to the nature of the ground, generally it may be taken as varying in breadth from $\frac{1}{4}$ to $\frac{1}{2}$ a mile or more. The breadth is determined by the steepness of the slope which in turn determines the depth and quality of the soil. The third zone rises to the summit of the hills. The shore belt is mainly composed of small sized branchy spruce and Red alder. The latter species attains a fair size. Many good stems up to 16 inches in diameter were seen. The middle narrow zone is where the valuable timber occurs. The forest association is spruce, cedar (Thuya gigantea) and hemlock. The Douglas fir is here absent.

The age of the spruce varies, but taking what seemed to be the average, *i.e.*, 150 years for trees still sound and healthy, it was found that the average diameter was 40 inches. The hemlock is slower in growth, the average being about 32 inches at 160 years. One very large spruce stump of 56 inches diameter showed 373 annual rings. The spruce is best on the plots and shows a marked improvement in moist hollows, even in plots in the shore zone. Higher up the slopes of the mountains growth falls off considerably and the number of what are locally called spike topped (*i.e.*, stag headed) trees increases.

Natural regeneration was abundant in the recent clearings and openings, the hemlock being more abundant than the spruce, which it appears to be ousting.

At the head of Cumshewa inlet where the spruce, cedar and hemlock are all good, I saw a pine area which had been devastated for aeroplane spruce during the war. The condition in which the ground has been left is not satisfactory as far as regeneration of the spruce is concerned.

I visited several logging and felling areas on the islands and found in all cases, as was to be expected, that only the finest trees were being felled. Seed from these trees was obviously desirable. Arrangements were made with the forest officers and the Indian agent that collection should only be made at specially selected logging sites.

The cones are collected by Indian families under the direction of the agent. Hitherto owing to the great difficulty in penetrating into the trailless forest and the impossibility of climbing the trees, the collectors confined themselves to collecting along the shore line. Small trees were felled to get at the cones, while larger trees had slots nailed transversely to the stem, ladder wise, for the purpose of climbing. Many of those slotted trees were still visible.

A day's sail up the coast from Cumshewa leads to a trail which passes over an extensive table land and then leads down to Masset Island on the north of Graham Island. Rising towards the marshy boggy table land the spruce-cedar-hemlock formation gives place to lodge pole pine, which in some parts shows excellent growth and form of development.

The spruce in the north has been more heavily exploited than in the south, but is generally of the same type and form.

Fraser River Valley.

The Lower Fraser Valley extends from the coast in an easterly direction to the town of Hope which is situated about 100 miles inland. At this point the Fraser Valley takes a northern bend and its topographical features change. Hope is the eastern limit of the climate of the Lower Fraser Valley. The average seasonal climate of this part of the Valley is practically identical with that of the east coast of Vancouver Island. The Fraser River Valley therefore cannot be regarded as a homogeneous unit, in the geographical range of the Douglas fir, hence to speak of the Fraser River variety of the species is very misleading. There is great variety within the valley plain, bench lands and Canyon, broad stretches of level plain rising gently to the higher elevations. Narrow parts with abrupt and steep slopes, soil conditions and elevations also vary. I saw in the lower Fraser Valley types of Douglas fir equal to anything to be seen on the west coast of British Columbia or on Vancouver Island. I visited about 10 centres where cones were being collected this year. The type of Douglas fir at each place was of fine quality. The collecting is being done by settlers all of whom are or have at one time been closely associated with the forest service, and the work is being superintended by specially instructed members of the forest staff.

The first shipment of Douglas fir seed arrived here on January 15th. It is contained in sacks holding 20 lbs. each, and these are packed for shipment in strong wooden boxes which hold 15 sacks each. One slight defect in the preparation of the seed lies in the winnowing, it is therefore again put through a fanner here before being despatched to the nurseries.

The mean daily temperature during winter,* spring, summer and autumn in the Lower Fraser Valley is 37°, 48°, 61° and 49° respectively. The corresponding figures for the Queen Charlotte Islands are 33°, 44°, 58° and 46°.

The total precipitations in inches during the four seasons in the Lower Fraser Valley are 21, 12, 6, 21, and in the Queen Charlotte Islands 33, 19, 13, 38.

A. W. Borthwick.

THE WORK OF THE FORESTER IN CHARGE OF A FOREST.

It so happens that in my district the forest areas that I am required to administer are very widely separated, with the result that I cannot give the personal attention to each one that it ought to receive. This is very likely the case in other districts as well, and I thought it might be interesting to review quite shortly how this affects the forester in charge, what extra work it throws upon him, and how he may be best equipped to meet it.

The foresters who are serving under me have come to me more or less haphazard. They vary greatly in previous education, in practical

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* Winter is taken as the months of December, January and February; spring the next three months, and so on for summer and autumn.

experience, theoretical knowledge and general ability, each one possessing some one quality perhaps in excess of the others.

In the first place it is suggested that really good and responsible work can only be obtained if the forester is given every opportunity to develop his own sense of responsibility. A senior officer giving minute and detailed instructions how this, that and the other thing is to be done will probably get the work done to his own satisfaction in these particulars, but in other things, where instructions have not been given, unless the forester is used to act for himself there may be serious omissions.

Probably in most of the forest areas under the Commission men have already been put in charge who have good practical knowledge of how the various operations, such as fencing, planting and nursery work are to be carried out, but it is submitted that, especially in outlying districts, much more than this is required.

Finance is the very blood and sinews of the afforestation movement, but on this subject occasionally foresters have somewhat elementary notions. The forester in charge of a forest ought to have a very good notion of his own budget. He should not be content merely to carry out works that he deems to be necessary in the hope that the money will be found somewhere. The roughest and most elementary method that he can apply is to divide his total expected labour bill by the number of acres to be planted in the year's programme, and then cogitate on the result. To effect this I suggest that a forester should always be asked, in the first place, to prepare his own estimates—that is to say, he should work out his quantities, and apply his cost per unit. He should then have a good knowledge of the number of men he is likely to require at the various seasons of the year, and will not find it necessary to tide men over with makeshift jobs between two busy periods, as has sometimes occurred. If he does this he will probably require little supervision in the engaging and employment of his labour gangs.

Then the forester ought to have a clear notion of the general intentions with regard to the forest, whether they are already enshrined in a working plan or not. This will particularly assist him in the nursery programme, a subject on which, possibly not entirely from their own fault, some foresters have rather vague ideas. Foresters will sometimes undertake drainage schemes, manurial schemes, elaborate gravelling of paths, etc., to the great improvement of the nursery, but to an extent which they would never have entered upon had they worked out for themselves the cost as compared to the output of plants.

These are matters, it may be said, which the District Officer ought to control, and so he should, but if he has a number of widely-spread areas to attend to his work in this respect will be greatly assisted by the forester's own comprehension of the governing principles.

To aid in this I have encouraged the foresters in my district to prepare annually a tracing of their nursery, which is coloured in three colours to indicate the area under seedlings, transplants or manurial crops. The accumulation of these maps will and does keep them right on the question of rotation, besides adding to their own interest. The foresters are also now asked to prepare for their own satisfaction,

and not necessarily for transmission to headquarters, a profit and loss account roughly on the lines of that first submitted by Mr. Annand.

Again, it may be urged that this is the work of the District Officer. I admit that it is and probably he has some share in it, but the point I am trying to make is that work of this sort by the forester not only much improves his efficiency, but also interests him.

These things will require from the forester a good deal of intelligent thought. Possibly some might be much assisted if they could be allowed to go on a short course. It might even be of service if they were permitted to spend a short time in the Divisional Office in order to study the returns, financial and otherwise, called for by headquarters, and to get some insight into the very real reasons for them. The annual report, as now called for, is a long and complicated compilation. Its preparation in the North Divisional Office this year took a great deal of time, and called for a good deal of correspondence. It will, however, provide a valuable record. If in future years the foresters in charge of areas are able to fill in previously prepared schedules accurately, a great deal of labour will be saved.

From the foregoing remarks it will be seen that the duties of a forester in charge of a separate area are many and varied. In addition to being what is known as a good practical man, his position requires him also to be a fairly good clerical man.

There is, I know, a real risk that the time spent by a lower grade man in reporting on his work to a higher grade may grow to be out of all proportion to the time spent in actually doing the work, but I do not suggest that these additional calculations by the forester should necessarily be reported. He should be encouraged to undertake them primarily for his own guidance, and not for any one else's.

The suggestions which were once put forward for a central library do not appear to have borne fruit. Access to books on technical subjects would, I think, be of value to foresters in charge of areas. Such booklets as that published by the U.S. Forest Service on Nursery Practice, a copy of which was sent to the Divisional Office, strike one as being particularly valuable for circulation to foresters. Copies of the findings of the Experimental Department might also be made available.

The intention of this short paper is to draw attention to the important status of a forester in charge of an area. The amount of his responsibility is not always fully recognised.

As he often has to live in remote and unfrequented parts the plea is put forward that every effort should be made to provide him with a comfortable home.

L. A. NEWTON.

THE GREEN SPRUCE APHIS.

In the last issue of this Journal some notes on the Green Spruce Aphis were given, together with a request that officers and foresters might assist in estimating the insect's importance and prevalence by reporting its occurrence in their districts. One or two reports were received, but most of the information on the insect's distribution given

below is based on information received from private individuals who sought advice on remedial measures, and on observations made by the writer.

Distribution and Prevalence.

The distribution of the aphis is general throughout Britain. It has been reported or observed in all the southern counties of England, in Wales, and in the Midlands. Mr. Guillebaud reported it as especially abundant in the Isle of Man last spring. No reports have been received from the Border counties of England. In Scotland the aphis has been reported or observed throughout the west, as far north as Borgie and on the east from Elgin to Howick.

In most, if not in all, districts the aphis has been unusually prevalent since the winter of 1921, but is now apparently decreasing in numbers, from what causes is not definitely known. A small chalcid parasite, and various species of ladybird beetles and hover-flies have doubtless checked it in some districts, but in others weather conditions seem to be more important. In several instances spruce shoots, heavily laden with ladybird larvæ, were submitted, with the suggestion that these larvæ were defoliating the spruce, and in all of them further enquiry showed that the ladybirds were attracted by the presence of the aphis, and were rapidly destroying it. Two species of ladybirds were reared from larvæ thus sent in—the two-spotted ladybird (*Adalia bipunctata* L.) and the seven-spotted ladybird (*Coccinella T. punctata*).

At Inchnacardoch parasitised aphides were found on every shoot, although in small numbers. They are easily recognised, presenting a bloated appearance, and becoming a golden brown colour. A number of these parasitised aphides were collected, but owing to the too dry atmosphere of the laboratory the parasites failed to emerge, although dissection of the aphides in October showed that the parasites had completed their metamorphosis, and had died through lack of moisture. The parasites appear to belong to the genus *Aphidius*, and may yet prove important. No attempts were made to rear various hover fly (Syrphid) larvæ found feeding on the aphides, but these, too, must be considered valuable auxiliaries. They are to be found crawling among the spruce needles, every now and then extending the frontal region of their bodies, which terminates in sharp mouth hooks. When at rest these larvæ are somewhat flattened, and may resemble a scale adpressed to the twig.

These three groups of insects—ladybird beetles, chalcid wasps or flies, and hover-flies—together with various spiders, have undoubtedly played an appreciable part in checking the aphis, but how far they will finally check it is uncertain, and more information on their occurrence and importance is wanted. So, too, with weather conditions. On 17th May last, at Spean Bridge, the aphis was reproducing during a storm of sleet and snow, when the temperature was little above freezing point. On the following day at Inchnacardoch viviporous reproduction was also in progress, and it seems evident that temperature alone is not a critical factor in the aphides economy. This is not unexpected, for, as Bachmetjew and others have shown, low temperatures, even if prolonged in duration, are much less destructive to insect life than suddenly alternating low and high temperatures.

Extent of Injury Caused.

The extent of injury caused by the aphis in Sitka spruce plantations is still uncertain, but the following notes on observations made in various districts indicate that the losses will not be so severe as was anticipated.

At Inverliever a number of Sitka spruce, ten to twelve feet in height and nine or ten years old, were examined, and their condition noted on 14th May. None of these trees was severely defoliated, although in some the last year's and previous years' needles were destroyed. They were again examined by Mr. R. N. Chrystal in September, and all were showing good growth. In the rare cases where the terminal buds had died, adventitious buds occurring at various points on the defoliated shoots had replaced them.

At Inchnacardoch defoliation was more severe than at Inverliever, and many terminal buds were killed. They had, even in May, however, been replaced by adventitious buds, which were beginning to swell and open. In other cases of attack reported, recovery has not always taken place, but at the time of writing no estimate of the percentages of loss are available. On older trees under observation at Kew many shoots have died back, and have been replaced by adventitious buds arising in the shoot axils. On the whole it may be expected that, except where other adverse factors, such as recent transplanting, bad or too deep planting and frost, come into play the Sitka spruce will survive moderately heavy aphis attacks. Nevertheless the spruce aphis constitutes a menace to the Sitka spruce plantation, and further study of it is urgently necessary.

Control by Spraying.

The only mechanical method of checking aphis attack is by spraying the trees with a good "contact" insecticide. Two such sprays are available, the paraffin spray and the nicotine spray. Both are efficient if properly applied, but the nicotine spray has the grave disadvantage that it is a highly poisonous one and must be handled with care. It is moreover expensive and except when purchased in a proprietary form, such as "X.L. All Nicotine," not always easily procurable. Paraffin sprays are more easily obtained and made, but unless thoroughly emulsified and carefully applied readily cause scorching and may then do more harm than good. There are several formulae for paraffin sprays in use among fruit growers and horticulturists and of these two are suitable for general spraying. The Riley-Hubbard formula which is widely used in America is as follows :—

Paraffin	2 galls.
Boiling water	1 „
Soft Soap*	½ lb.

Dissolve the soft soap in boiling water, and when still boiling pour into the paraffin and churn into a creamy liquid. Dilute for use one part of this emulsion with from ten to fifty times the bulk of water.

* This is Theobald's recipe. Wardle & Buckle advocate hard soap. (*Principles of Insect Control*, 1923.)

This formula gives a wide range for dilution and at its weakest the spray may be used in summer. At its strongest it should be used only in early winter. It is essential that churning of the emulsion should be thorough. This can best be ensured by churning the liquid by a garden syringe with a rose nozzle. By filling the syringe and discharging it again and again into the emulsion a good creamy emulsion can be obtained. The object of the emulsion is to ensure thorough mixing of the paraffin and water and to increase the spreading and wetting power of the spray.

Theobald* also recommends a Paraffin Jelly formula as follows :—

Paraffin	5 galls.
Soft Soap	8 lbs.

Boil the soft soap and paraffin together and when boiling add one pint of cold water and stir well. This becomes a jelly on cooling. Add 10 lbs. of the jelly to every 40 gallons of water and use only in winter.

Of the various paraffin oils on the market Spencer Pickering of the Woburn experimental farm recommends the brand known as Solar Distillate. In the Woburn experiments† it was found that the higher the boiling point (in fractional distillation) of the oil the higher its killing effect in emulsion, and of the heavy, high boiling-point oils, Solar Distillate gave the best results. It is obtainable from Messrs. Capel and Leonard, Hope Chemical Works, Hackney Wick, London.

While pure paraffin is a much more efficient insecticide than diluted or emulsified paraffin its use is prohibited owing to the scorching effect it has on plants and trees. The shale paraffins as obtained in Scotland contain sulphur and other compounds deleterious to trees and even the purer natural paraffins are liable to cause scorching. Pickering and others have sprayed trees with pure paraffin without ill effect, but Pickering describes such experiments as "heroic remedies" to be applied "only to trees which are of no great value." He considers undiluted paraffin too dangerous a substance to apply to trees even in the dormant season.

Diluted paraffin if not properly emulsified may itself cause scorching and Mr. L. S. Osmaston has reported a typical instance of the dangers which the careless use of paraffin entails. In the instance reported the splashing of spruce foliage with a mixture of paraffin, soft soap and water scorched the foliage and killed many of the trees treated.

The main points in spraying with paraffin against the spruce aphis are :—

(1) The emulsion used should be thoroughly churned by means of a syringe with rose nozzle.

(2) Weaker emulsions frequently applied are safer and more fruitful of good results than strong emulsions applied once.

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* Theobald, *Insect Pests of Fruit*, 1909. (Privately printed.)

† Duke of Bedford and Spencer Pickering, *Science and Fruit Growing*, 1919.

(3) The spray should be applied with a proper nozzle and that both sides, but especially the underside, of the foliage or needles should be sprayed.

(4) The ground at the base of the trees should be sprayed to destroy any aphides which have dropped from the tree and might re-infest it.

Many good sprayers are on the market and some are already in use in some of the Divisions. The knapsack type is one of the best and any well known make can be relied on. The chief points in a sprayer are good nozzle, good pump and well fitted taps and good tubing. Sprayers should always be emptied after use. In nearly all sprays thorough mixing of the ingredients is necessary and spray fluids which have been left standing in a sprayer for months are not only useless but dangerous owing to the precipitation of the emulsifying ingredient or, as in lead arsenate, of the active ingredient itself.

Little need be said of nicotine sprays as Divisional Officers have already shown a distrust of highly poisonous fumigants and insecticides. Where nicotine spraying can be entrusted to a reliable forester or foreman nicotine is a very useful spray, however, and one of the best proprietary forms of nicotine has already been mentioned. Apart from their poisonous nature nicotine sprays have the drawback that they are expensive and that as they are often very efficient there is a tendency on the part of those entrusted with them to use them in excess.

It should be stated that the use of the paraffin sprays given above successfully reduced aphis attacks in nurseries at Port Clair and Seaton.

J. W. Munro.

PIECE-WORK PLANTING.

During my tours in the West of England inspecting planting schemes under the unemployment grants I did not come across one instance where the planting had been done by piece-work.

During the five planting seasons I have been in charge of planting operations under the Forestry Commission I have planted by piece-work, and in my opinion it is in many ways much more satisfactory than day-work planting. At the outset it must be clearly understood that only the very best, trustworthy, and reliable men ought to be put on piece-work. In most cases it is cheaper, and in every case it is much quicker than day-work. Small gangs are better than large gangs; seven men per gang being a good manageable number. Good supervision is positively essential, as also of course, it is in day-work planting.

My experience has been, that men will plant nearly twice as many plants per day on piece-work as they do when on day-work, and, with a few exceptions (careless workmen), the planting has been equally as good as day-work.

This season where the weekly wage is 27*s.* the men are being paid 1*s.* 6*d.* per 100 for planting on very rough, hilly and stony ground (notch planting with the 5 lb. mattock). At day-work they planted 300 per day which is 1*s.* 6*d.* per 100. At piece-work they plant between

500 and 600 per day, so that, actually on paper it does not look as though piece-work is any cheaper, but the loss of wet time which is paid for on day-work and of course is not paid for on piece-work, must always be taken into consideration; so therefore, piece-work is cheaper and much quicker than day-work. The checking of the number of plants put in may be done in several ways by the foreman.

Perhaps as yet, it is rather early to judge the merits of the two methods, but from all appearances (deaths, annual growth made, etc.) the piece-work planting is every bit as good, and in some cases even better, than the day-work planting.

G. LOWE.

THE PROTECTION OF YOUNG PLANTATIONS ON MOORLAND AREAS.

The protection of plantations, as everyone connected with forestry will admit, is of vital importance, for however well a plantation has been established, there are many causes, both organic and inorganic, which occur to hinder its progress.

All moorlands vary, the geological formation often differs, and some are of a greater altitude than others. The area which I am writing about is moorland running up to nearly 1,300 feet above sea-level. It is bare, and has never borne any timber crop whatever, and I propose to deal with its protection, now that it is being afforested, not in any special order, but to consider the dangers in their order of importance.

FIRE.

The chief danger undoubtedly is fire. This can originate from many causes, but probably the most frequent cause is from the careless dropping of matches, cigarette ends, etc. As we are in the centre of a great hunting country, members of the field, often very indifferent, can do great damage by neglect of care in this respect.

Several ways are open to minimise fire-danger, such as notice-boards, fire patrols on non-working days, etc., but here, where the herbage is mostly heather and dwarf furze, which especially in August and September is very inflammable, the greatest safeguard of all is, I am sure, the provision of adequate and properly-cleaned fire-lines, between each compartment, and around the whole area which may act as fire lines, compartment boundaries and eventually as transport roads.

We make these fire lines 30 feet in width at the time of planting, and in the summer cut 4 feet of herbage on each side of the road and rake it on the uncut herbage, which is 22 feet in width. When dried off about six men are required to burn this, and to keep the fire under control by means of birch branches. We always burn with the wind, the first strip to be burned being on the leeward end of the road, so that succeeding strips burn towards our own ground (*i.e.*, the ground just burnt over), taking a small strip at a time, the length of the strip depending upon the force of the wind. If there is a side-wind, the work is more dangerous, and more care has to be taken and a smaller strip taken at a time. In this case the line of fire must be obliquely across

the road, having the longer line of fire on the windward side. When the fire reaches the edge of the cut 4 feet strip, it is beaten out, and great care must be taken to see that no smouldering peat fires are left.

We burn our roads like this at comparatively high altitudes, where there is generally a high wind, the chief things being to have plenty of herbage to burn to make a clean job of it, and to burn over your own ground. The general cost varies of course, but runs between 2*s.* 6*d.* and 4*s.* per square chain on Exmoor.

Rabbits.

The next danger most certainly is rabbits. The ordinary height of wire-netting, 3 feet 6 inches out of ground, is I am certain inadequate. I have repeatedly seen rabbits climb this, especially when chased, and all netting should have a strand of top wire, for attachment and support, otherwise ponies and bullocks are liable to slacken and break the netting which then affords no protection whatever.

As regards rabbit extermination, it is not necessary to deal with it in detail, but continual trapping and ferretting, and drives to cut rides in bracken areas, where they can be shot, reduces their numbers to a great extent. But much more might be done indirectly, by preserving their enemies, *e.g.*, foxes, stoats, and hawks, and it would be well for foresters to realise this, and not to see in every hawk, or stoat, a thing to destroy.

Black Game.

On Exmoor there still lingers a remnant of Black Game, and though by no means numerous these birds can do a great deal of damage to young plants, by devouring their buds.

From my observations, their natural food is heather and whortleberry tops, but though this food is abundant, it by no means deters them from attacking the young trees. They are very partial to the buds on the leaders of Scots pine, and they also attack the Corsican pine but to a lesser degree, taking sometimes the terminal bud only, but generally the whole cluster is destroyed, thus causing the plant to become bushy and stunted, by the development of many leaders instead of one.

As these birds are "game," one is restricted in dealing with them, the only apparent means being to shoot the birds, and destroy their nests, the nesting-time being in June.

Heat.

On bare moorland this is a great danger, but may be counteracted to some degree by retarding the weeding of bracken areas during a hot summer, the preserved bracken covering thus shading the plants, and preventing evaporation of moisture from the ground.

Wind.

It is well, I am sure, not to screef too much on heather lands, the heather protecting the young plant from cold and winds to a very considerable extent, and also a certain struggle for existence is set up, consequently the young tree is "drawn up" reasonably.

GENERAL.

These are the greatest dangers in establishing young plantations on bare moorlands, but of course others will occur.

Hylobius will not be dangerous, owing to an absence of breeding-places.

Bullocks and Ponies, if allowed to break in, will bite off plants, besides breaking the netting and thus enabling rabbits to get in. Red Deer, which here are numerous, have apparently done no damage to adjacent coverts, and perhaps may do negligible damage to our plantations. Lastly, much good may be done by respecting reasonable compliance to the wishes of local people, and by using tact as regards common rights, which are often said to exist, although they may not be strictly so legally.

G. WILLIAMS.

THE SIZE OF PLANTS IN CONNECTION WITH WEEDING.

In writing the following article the fact is fully realised that the abnormal failures of the planting seasons 1921 and 1922 have upset and will continue to affect the available plant supply at the disposal of the Commission. A great deal of what is set forth here, therefore, must apply in a large measure to years ahead, though by the exercise of discretion the forester may utilise his allocated plant stocks to the best advantage.

On most operations there are areas of bracken and grass in which weeding is essential. On the upper slopes above say 500 feet, where there is no protection from the wind, the grass is usually found to be thin and sparse. If screefing be properly executed no weeding is necessary as a rule in these places. In the hollows, however, between two minor shoulders of a hillside, the vegetation will usually be rank, enjoying as it does the advantage of shelter.

By judicious selection of the biggest plants (and there is invariably a percentage of large plants among an average batch of medium size), and planting them where the growth of weeds is bound to be most dense, the following results are obtained.

First, the smallest plants are placed on the most exposed situations where they stand a far greater chance of living than large ones would. Second, the larger plants are more easily found in the heavier growth than the smaller ones, and time is thereby saved which means a reduction of weeding costs. Third, after the second year's weeding the tops should be so far up that the third year's shoot will be out of the danger line. This may seem fairly obvious, but the point to be emphasized is that we are now considering not bracken, but grass and weeds, which are not as a rule weakened by successive cuttings, and until finally smothered, grow year after year to the same height. The importance of using the largest plants available for such places cannot be too often reiterated at the present stage of the Commission's progress, when, with the plant supplies depleted through the drought of 1921, and its consequences, large areas of early formed plantations have still to be weeded, while further areas are added to the area to be weeded each year. It means that on hillsides where grass and weeds grow rank

only in the hollows, these relatively small patches may be left till the imperative demands of bracken weeding are satisfied. Then these patches must be weeded, as if not done it will probably be found in the case of small plants that mildew and want of light have ruined the trees for years to come or else that the weight of the wet grass has bent and weakened the leading shoots.

Passing from grass to bracken areas, the debatable question of plant sizes arises. Local conditions vary so very greatly that hard and fast rules are difficult to formulate. A census of the opinions of the various officers in all parts of the country would probably be of value as indicating the general average of the sizes required. The writer has come to the conclusions set out below. (It must be understood that modifications for various species are necessary.)

For exceptionally tall bracken up to or exceeding six feet in height, transplants of eighteen to twenty-four inches when available are best. It will generally be found that exceptionally tall bracken is fairly thinly distributed on the ground. It is therefore possible to use quite small plants, as mildew risks are low owing to the free circulation of air among the almost frondless lower reaches of the stalks. Among such bracken also, very little other vegetation is generally observable, and the plants are easily found when weeding. Against this must be set the longer period which it will take the smaller plants to get above the bracken. Nine to twelve inch transplants will as a rule require one more weeding than those of eighteen to twenty-four inches in length, among the tallest bracken. Reckoning the extra weeding cost at 6*s.* an acre this amounts to a very considerable sum over large areas, and there is also the final compound interest on the original cost of planting and upkeep to be considered. It would seem that the remedy lies in wrenching or undercutting the plants in the nursery, and leaving them for a further year. Assuming that the planting-out distance is six feet by six, or twelve hundred and ten plants per acre, the area taken up in the nursery will be about twenty-five square yards. The cost of wrenching and weeding and the slight additional transport consequent on using larger plants should work out at about 2*s.* 6*d.* per acre more than if nine to twelve inch plants were used, which means a final saving of 3*s.* 6*d.* per acre when weeding is reckoned in.

In the case of the medium length bracken, which is usually thick on the ground, similar plants to those for the tall bracken are recommended. With this type of growth, however, which of all the brackens is the most prolific producer of mildew, smaller plants should be avoided, as they are difficult to find, and the young shoots are just where the vegetation is thickest, retains moisture, and is conducive to the conditions favourable to mildew and heavy shade damage.

For bracken of similar length to that just dealt with, but lighter on the ground, twelve to fifteen inches is considered the best length, and for the shortest of all, usually found at the higher elevations, six to ten inches.

The writer is of the opinion that adherence on broad lines to the above principles would reduce weeding costs, minimise mildew risks, and give greater uniformity to the later appearance of the plantations.

F. R. Hurworth.

THE FORESTER'S FIGURES.

It is not unnatural that a forester should look upon the preparation of the various reports, returns and statements which he is called upon to render, as work of secondary importance. But the extreme view is sometimes taken that such work is of no real value, except in providing the office people with something to do. And this view, too, is not altogether inexplicable, for it is in the experience of many that a forester in private service is not asked to do anything approaching the amount of "figuring" work that is included in the duties of the Commission's foresters.

The facts that are overlooked are that afforestation as a national undertaking is a new experiment in the British Isles: and that the successful carrying out of any national scheme requires the existence of a body of statistics and known facts upon which plans may be based and anticipatory calculations made. Such data, as far as forestry in the British Isles is concerned, are scanty: and it is an essential part of the work of the Department's present personnel to build up a body of information for the use of their successors.

Information prepared by foresters bears a greater share in this work than is, perhaps, realised by the foresters themselves. Even taking a short view, it is surprising how far the forester's figures go. As an instance: The Department's annual programme is based upon Divisional Officer's estimates; which are based upon costs and quantities supplied originally by foresters in their Progress Reports, Time Sheets, Nursery Records and the like. The necessity for the work, and for reasonable accuracy in it, becomes more apparent when its far-reaching nature is thus emphasised.

Where the far-reaching effect of their figures is understood, foresters are not likely to underestimate the value of reasonable accuracy. The devastating effect of occasional inaccuracies is not, however, always fully appreciated. Where a calculation is made from several factors, an inaccuracy in one factor not only renders the result of the calculation useless, but may also result in the time and trouble spent on the accurate preparation of the several other factors being wholly wasted. Instances have occurred where a year's careful recording of expenditure on several nursery beds—with a view to ascertaining prime cost of production—was found to be quite useless because the original "count" of seedlings was very inaccurate.

In short, the accuracy required is a *constant* reasonable accuracy: not accuracy to several decimal points, but that general correctness which results from the use of good judgment on those many matters wherein a forester has to make a decision or an apportionment as to this or that.

The value of his figures to the forester himself should not be overlooked. In Divisions 3 and 4 it is the practice for all officers in charge of operations to show the labour cost per unit of all work on their Weekly Progress Reports. Extra work is entailed on the forester but it is worth while and has many advantages. Costs worked out by a man himself are more real to him than figures supplied (probably after a considerable interval) from a distant and suspected office. Moreover,

as the figures are available whilst the work is in progress, there is time, should the cost of some particular work show high, to search for causes and apply a remedy : which opportunity seldom occurs when comments upon costs are received from the Divisional Office or H.Q.

It has been objected that there is an incentive to avoid trouble over high costs by " adjustments " in the Progress Reports and Time Sheets. Such " adjustments " have, in fact, been made. But very rarely : and where foresters appreciate the use and necessity of costings, the likelihood of such practice is not great. For it is soon realised that a high cost is either justifiable or not. If justifiable, causes can be shown ; and " strafes " are not very much felt when the recipient is conscious of being right. If not justifiable, the cause can be found and removed. That this is quite naturally done is proved to a certain extent in the writer's opinion, by the fact that since foresters in one particular Division have ascertained regularly their own costs there has been an appreciable improvement in the figures as compared with those formerly ascertained in the Divisional Office.

The incentive mentioned above, to juggle with Time sheets and Progress reports, has certainly been over-estimated. The probable reason is that it comes home very forcibly that time and ingenuity so perversely expended is much more than wasted—inasmuch as not only are useless figures produced, but other good work is actually nullified.

C. PINK.

MAKING THE MOST OF YOUR SEEDLINGS.

When lifting seedlings, one-year or two-year, from seed beds for transplanting, it is generally found there are many undersized, especially if seedlings are dense in the beds. These very small seedlings are often lost or destroyed, being too small to use in transplanting boards or plant with dibbler or ordinary notch with the larger ones. During the scarce years the writer managed to save many thousands by the method described below, which, although not new, is not generally used, except perhaps in Scotland.

This method not only applies to the smallest seedlings in ordinary beds, but where a poor crop is scattered over a large area, and would have to be weeded a whole season, with the loss of valuable space. It is much more economical to re-bed these seedlings.

Treatment.—Prepare bed 4 feet wide as you would for seed, but soil need not be worked to so fine a tilth. Puddle roots of seedlings if weather is very dry, cut upright notch across bed 2 inches to 3 inches deep, lay seedlings in 1 inch apart, replace soil and firm well. The next notch is cut 2 inches away, and so on down the bed. It will be found 42 seedlings will go to a row, leaving 3 inches each end to allow for crumbling away of the soil if the bed is raised above the path. Eighteen rows go to each yard of bed, thus 42 by 18 = 756 seedlings per square yard.

This work can very well be done by two boys, one working each side, and the cost works out at about 1*s.* 6*d.* per thousand. The greatest

saving is in cost of weeding as compared to nursery lines, where very small seedlings, if lined out, would have to be weeded an extra year.

The writer at present has 20,000 Douglas re-bedded last April, when their average height was 1 inch, occupying 27 square yards of ground. The tallest of these are now 12 inches high, with an average of 9 inches for the lot.

Douglas fir and Sitka spruce are especially suited to this method, as their dense foliage keeps down weeds, so that the cost per thousand plants for the whole season is very small. Other species do well, but more weeding is required. Many of these largest plants will be fit to plant out in the forest at end of the year, while the others can be re-lined.

T. Brown.

BLACKGAME.

Damage done to Young Forest Trees at New Galloway Forest.

Part of New Galloway Forest, about 260 acres in extent, which was kept as a rabbit warren by the proprietor previous to being taken over by the Forestry Commission, is particularly infested by Blackgame. This area is between New Galloway Station and the lower end of Loch Ken, and is isolated from the main portion of the forest. It is bounded at the north side by a birch plantation about 40 years of age, which is an ideal habitat for Blackgame, and at the south side by an oak plantation 60 years of age ; at the east side it is bounded by Loch Ken. On the other side of the Loch, which is a very short distance across, is rough land growing heather, bracken, gorse, scrub of various kinds, with clumps of birch here and there ideally suited for Blackgame. This is where the majority of these birds nest and spend the winter months, starting to gather into flocks about the end of September or beginning of October. They then come across and congregate in the " Rabbit Warren," as this area is known locally, and there they remain more or less all the winter, till about the middle of April. It would appear at times as if all the Blackgame in the district congregated in this area. The first winter of planting, 1921–22, flags were tried and shifted every day, but they soon got accustomed to these. Scarecrows were next tried, and also shifted every day, but were of no avail. The birds would come and feed within 10 yards of them. Shooting was also resorted to, but although it lessens the numbers at the time, it is of no avail as regards scaring the others. I have seen a flock of birds getting up, and after a pair or more had been shot out of them alight again within a couple of hundred yards, and commence feeding as if nothing had happened. The Rabbit Warren, before being taken over by the Forestry Commission, was an ideal place for Blackgame, a belt of about 60 yards wide and 600 yards long, comprised of hazel and other scrub ran along the loch side at the north-east end, with a small oak plantation in the centre. These, with the plantations at the north and south boundaries, afforded good cover for them, and distributed practically over the rest of the area were scrub bushes of various kinds, such as hawthorn, etc. The ground, with the exception of a few fields along the side of the loch, is of a rough nature, growing a dense crop of bracken

in the summertime, with patches of heather in places. During the first winter of planting, 1921–22, Scots pine were attacked as soon as planted, the buds of practically every plant being eaten ; next the Sitka spruce were attacked, and 60 per cent. of these were stumped to the ground. The area where Sitka were planted grew a dense crop of grass, and to make screefing and planting easier, this was burned. As soon as this was done Blackgame started to frequent it. The next winter the spruce areas were covered with a dense growth of grass, the plants were all showing where the grass had been cut back, and not one single Sitka plant was touched by Blackgame ; this seemed rather a contrast after the previous year, and I am of the opinion that the burning of the grass before planting had to do with it. During the winter of 1922–23, however, they attacked the larch, and did considerable damage amongst them, and again attacked the Scots pine and a few of the Corsican. They are not so keen on the latter. Early this season at the beginning of October I treated the buds of Scots Pine and some *P. contorta*, which were planted last winter, with a mixture of Archangel tar and tallow (2 parts tallow to 1 tar), boiled together and applied to the buds. A short time after—the mixture was applied during hard frost—they attacked these plants as if they hadn't been treated (the same mixture was used at Aucheninnes, and proved effective from the beginning). I had them done again, putting more tar in the mixture, and no more buds were picked. Only in isolated cases, and then only an odd plant here and there, have I found Douglas being touched by Blackgame.

Where Blackgame are very numerous it may be an effort to get a crop of larch or pine—particularly the former—though I am strongly of the opinion that by effective treatment with the above mixture pine could be grown. The mixture must be applied early, say about the first week of October. Where an area is infested with Blackgame it is useless to plant 2-year seedling larch, as they will in all probability be stumped to the ground every year, and finally die. Even at 18 inches and 20 inches high I have seen them jump up to the tops and eat them down. In my opinion the most effective way would be to plant larch 20 inches to 24 inches high as late in the season as possible, before they start to bud out, on the chance that they will get beyond the reach of blackgame by the following winter. They would be more expensive to plant, and there would probably be a few more deaths, but this risk would be worth taking.

Too strong measures cannot be taken against these destructive pests, and their numbers should be reduced on all possible occasions. They are very wary and difficult to shoot. When feeding, these birds are always on the alert—one bird is always " told off " to be on guard, and will be seen perched on some high place, where he can see all round, while his mates feed in safety. If anyone approaches off he goes, and the rest follow. On putting up a nice Blackcock one day a friend of mine said, " What a magnificent bird he is." This remark was decidedly true. The Blackcock is really a magnificent bird, and makes a nice shot when driven over, but this is all that can be said in their favour. As a table bird they are only third class, their flesh having a tendency to taste of pine, though not nearly to such an extent as their nearly related friend the Capercailzie.

There is nothing more annoying to the forester than to see nice young plants eaten up by these destructive pests. In the interests of forestry these birds should be classed as vermin the same as the rabbit, and the Forestry Commission should have the power to destroy them the whole year round.

S. H. A. PATERSON.

NOTES AND QUERIES.

EFFICACY OF PINE BEETLE TRAPS.

There is a small area of Scots pine (about 7 ac.) in Chopwellwood, which is 28 years old and which for a number of years prior to 1923 has suffered severely from Pine Beetle.

Last year measures were undertaken to combat the beetle and the results have been very satisfactory.

The wood required thinning and the original idea was that the thinnings should be taken out in three stages and all utilised as trap trees. The first thinnings were made in February and shortly afterwards the beetle commenced to breed on these.

They were barked in May and the bark containing the larvae was burnt.

A further thinning was then made to provide more trap trees, but it was found that there were practically no beetles left, and it was unnecessary to bark the remaining trees taken out as they were quickly converted into pit props and sold to a local colliery.

The tops of the pines made quite a good recovery last summer and thia winter not a single broken shoot is to be seen on the ground, whereas the previous winter the ground was littered with shoots.

A. D. HOPKINSON.

NATURAL REPRODUCTION OF BEECH—CHOPWELLWOOD.

There is very little natural regeneration of beech in Chopwellwood and as there is from time to time a very good germination of seedlings I decided last spring to investigate to some extent why and when the seedlings died.

A plot one yard square was marked off on May 19th in a position where there was a good crop of seedlings springing up. The plot was under the projected area of the crown, but near the outside of the beech producing the seed and there was plenty of light for the development of the seedlings. The soil was a fairly fine loam over a subsoil of clayey nature and the vegetation consisted of grass and honeysuckle.

The number of seedlings were counted every month and the results were as follows :—

May 19th ..	.. 116	Sept. 20th ..	.. 38
June 20th ..	.. 124	Oct. 18th ..	.. 25
July 21st ..	.. 63	Nov. 11th ..	.. 11
Aug. 23rd ..	.. 53	Dec. 18th ..	.. 10

It will be observed that there was a very heavy mortality in July and after that a gradual reduction until less than 10 per cent. of the

original number remained alive in December. There was no drought or sufficient weed growth to cause the sudden mortality in July, but it appears to be almost certain that the reason was that up till that time the seedlings were living on their own food store and when this was exhausted they died as they had not got their roots well through into the mineral soil. The later mortality is more difficult to explain.

The cotyledons and primary leaves of a few were seen to be partially eaten by an insect that was not discovered, and a few might have been smothered in the grass, but no other cause of mortality could be discovered. The point that was noticeable all along was that the natural seedlings were far weaker than those produced by artificial sowing in the nursery close by.

A. D. Hopkinson.

Planting Pure Spruce at High Elevations.

It would appear to be questionable whether it is desirable to plant Norway spruce pure at high elevations, say 700 to 1,500 feet or even lower, on the ground which is bare and much exposed to persistent winds. It is very evident that spruce planted pure under such conditions and even in good soils suffer very severely in many cases from the effects of exposure to wind. This is seen in the complete defoliation of the young trees on the windward side, and their unhealthy apppearance and extremely slow growth. As far as my observation extends it has been almost invariably found in such situations that spruce does better in the first ten years if it is mixed with quicker growing species such as Scots pine and larch. The critical period is the time between planting and the formation of a canopy. As soon as the trees are close enough to protect themselves the greatest danger is probably past, but as spruce are very slow in starting at such elevations, it appears quite possible that in some cases the period may be so extended that the ultimate result of the plantation is seriously endangered.

I have mentioned Scots pine and larch as these are the principal species I have noted, but I think probably Corsican pine would be a better tree than either provided the soil was suitable. Then again the ordinary mixture of spruce, Scots pine and larch that one finds on private estates introduces far too many of the two latter species if the area is only suited for spruce as so many are. The arrangement which I should like to put into practice would be to plant rows of Corsican pine at right angles to the prevailing wind. They could be placed about every fourth to tenth row according to the severity of the exposure and should be planted close in the rows, say three feet apart, the object being to produce as it were a series of " walls " to protect the young spruce trees.

As the subject is not without importance on certain of the Commission's areas, perhaps other officers would give their opinions.

A. D. Hopkinson.

PLANTING EXPERIMENT WITH CORSICAN PINE IN CHOPWELLWOOD.

Last year an experiment was begun by planting a certain number of Corsican pine each week for a period of 16 weeks, in order to gain, if possible, some additional knowledge as to the best month to plant this species.

The area planted was of a uniform character as regards soil, sheltered, with a gentle slope south, and an elevation of 450 feet. The plants (aged 2 and 1 year) were from the home nursery, and planted under ordinary conditions, the ground being screefed and plants notched in.

As is well known the spring of 1923 was abnormal so far as planting operations were concerned, on no occasion during the 16 weeks was planting held up through frost or snow.

The plants have been counted at intervals of three months commencing July last to January, and the results, set out below, do not favourably advance the claims of any particular period included in the experiment. Taking the first eight weeks as compared with the last eight it will be seen the difference is negligible, while the amount of deaths over the whole is only 4 per cent.—a very low figure.

The main conclusion arrived at is: that the controlling factor in planting Corsican pine is the weather. Given favourable conditions it is of no advantage to defer planting this species till late spring, as is often the case.

Date when planted.	*Number planted.*	*Number alive on—* *July 13th,* 1923.	*Oct. 13th,* 1923.	*Jan. 13th,* 1924.
1923.				
Feb. 16th	50	50	50	50
„ 23rd	50	49	49	49
March 2nd	50	49	49	49
„ 9th	50	50	46	46
„ 16th	50	50	50	50
„ 23rd	50	50	47	47
„ 30th	50	49	47	47
April 6th	50	49	47	47
„ 13th	50	50	49	48
„ 20th	50	49	48	48
„ 27th	50	48	46	46
May 4th	50	49	48	48
„ 11th	50	50	49	49
„ 18th	50	50	49	49
„ 25th	50	50	46	46
Junelst	50	50	49	49

T. E. ANDERSON.

NOTES ON GLEN RIGH.

Aphis Abietina.—In the spring of 1923 defoliation of Norway spruce was noticed in Onich Church grounds and also in a neighbouring property. Along with other trees these were planted for shelter. Their

ages would be from 12–25 years. I was asked to examine these trees and found the damage had been done by *Aphis Abietina*. The attack must have been going on for some considerable time as a few of the younger plants were totally devoid of foliage. I advised cutting out the spruce and replanting with a different species, however this was not done and during the summer a little growth took place on the terminal shoots, but these were very stunted and unhealthy. The insect appeared to attack one tree after another in succession, the tree first became reddish brown in colour, then light brown when the needles were shed. The aphis could be seen quite distinctly with the naked eye.

Planting Methods on Peat.—On Glen Righ area a large amount of the planting ground is covered by an air-tight band of peaty soil varying in depth from 3 inches to 8 inches. In the ordinary way of planting (*i.e.*, with Schlich Notching Spade or Mattock) this heath band is unfavourable for the growth and establishment of the young plants. In a hot summer the notch invariably opens up owing to the contraction of soil, the same thing happening in winter with a hard frost. What I would suggest on such areas would be pit planting, the pits to be 6 feet to 7 feet apart and 12 inches to 15 inches in diameter, turf being cut off with a spade. The surface and sub-soil may be thoroughly broken up with a small pick. This I think would cost about 4*s.* or 4*s.* 6*d.* per 100. This work could be done during summer. An ordinary trowel could be used satisfactorily for planting. At 7 feet apart, I think one man could plant an acre per day or 880 plants. The probable cost would be 42*s.* per acre. This method is more expensive than notching, but I am certain the results would be much better.

The general vegetation consists of heather, nardus, scirpus and Juncus squarossa with molinia, in some places. Nardus, scirpus and Juncus I think denote poverty. This vegetation is apparently due to the peat band of poor surface soil as I have dug down to a depth of 18 inches to 2 feet and found the sub-soil quite suitable for planting, consisting mostly of slate moraine and disintegrated rock. Hence one reason for suggesting pit planting.

Avoiding Damage in Hoeing.—I have frequently noticed that when Dutch-hoeing nursery lines with new hoes that some men or boys are very apt to cut or bark the young plants. I have found it a good plan in the case of new hoes, to file the corners off althogether, making them quite blunt.

J. Rutherford.

Preparation of Scrub-Covered Areas by Girdling.

It has been observed on an exposed birch scrub-covered area, which was girdled two years previously in preparation for planting, that after a storm approximately 50 per cent. of the girdled trees had been blown down. These blown trees lay in disorder in various directions, some piled on the top of each other.

If this area had been planted, would the snedding and removal of the branches be advocated, or would the new plantation be allowed to

force its way through the fallen trees ? In regard to cost, we have to compare the cost of girdling and snedding and removing branches from trees lying in disorder, with that of snedding and clearing trees which have been carefully felled to give the minimum amount of labour in snedding. Therefore, in an area exposed to high winds, I am of the belief that the most economical procedure would be to fell instead of girdling.

In another area girdled in 1922, the foliage appeared as usual in the subsequent two summers, and this year the buds are already swelling. These trees were deeply cut to ensure effective girdling.

J. CAMERON.

APHIS ABIETINA.

Since the commencement of the keen frosts in January the aphis has completely disappeared from all affected plants in this locality. Whether this will be permanent remains to be seen.

J. CAMERON.

DAMAGE TO DOUGLAS FIR BY STROPHOSOMUS LATERALIS.

An unusual attack by a heather-feeding weevil on recently planted Douglas fir occurred at Churt last April. Normally, *Strophosomus lateralis* spends the larval stage on heather roots, and after pupation the perfect insect emerges to feed on heather foliage. The imago is about one-third of an inch long, lacks the typical elongated snout of most weevils, and is black in colour, with purple splashes on the sides of the elytra in early adult life.

In this case the heather had been burnt off just before planting took place, but the fires did not burn the roots, and *Strophosomus lateralis* duly emerged. Not finding its natural food available, the insect attached the newly planted Douglas fir, and almost all of the previous year's foliage was consumed. Fortunately the new shoots had not yet appeared, and hand collection successfully reduced the attack before the flush took place. When not feeding, the insects were grouped together on the tops of the plants, and could then be shaken collectively into the tins which the men carried. A wary approach was necessary, owing to the weevil's habit of dropping to the earth, and shamming death when danger threatened.

It must be noted that part of the area was stocked with two-year seedlings. Unlike the transplants, these did not stand the loss of the previous year's leaves before the new shoots appeared, and many deaths resulted.

If possible, any future heather burning in this forest will take place either a year before planting or in summer.

H. BLOWS.

NURSERY TOOLS.

The large size Bucco Cultivator, 5-prong, with long handles, is one of the most useful nursery tools for cleaning nursery lines when seed

weeds are in early stage of development. For this purpose it is simply dragged. Used as a hoe (draw) or as a mattock it is excellent for securing a good tilth in preparation of seed beds, and for removing perennial weeds. For breaking up ground with sun-baked surface or for keeping surface dusty in order to check loss of moisture during drought, this tool has no equal.

The small Bucco Cultivator, 3-prong, 2-ft. handle, is very useful for breaking surfaces and cleaning between drill of seedlings.

Both these tools should be used throughout the growing season, alternately with Planet Junior Man Hoe, Dutch Hoe, or small draw hoe. In early spring, or when the cleaning takes place after lining out, the cultivator should first be used, as it slackens any stones that may be near the surface, minimises the risk of damage by the hoe glancing off fixed stones, etc., and generally facilitates the cleaning of the ground.

F. SCOTT.

BIRDS.

Two outstanding instances of birds affecting forests were noted during the year, one beneficial, the other harmful. The latter refers to Blackgame, which on Monaughty, during late spring and early summer (April–May), did some damage to European larch. The damage done was to larch planted in P. 21 and P. 22. The tufts of leaves had the appearance of having been cut off close to the twig, the cut being as clean as if done by scissors.

On the other hand it is a pleasure to record that titmice are extremely numerous this winter, there being particularly large numbers of the Coal-tit (*Parus ater*), Great-tit (*P. major*), also a goodly number of the Blue tit (*P. coeruleus*), Crested-tit (*P. cristatus*), and Longtailed-tit (*Aegithalos caudatus*). The latter are to be found principally on the lower ground amongst spruce and Scots pine affected by Chermes, the other species of tit being found on the higher ground.

Of these species it would seem that the Blue or Town tit is the most useful. In January, 1924, these birds were noted to be tearing the bark of Scots Pine twigs to get at the larvæ of *Pityogenes* underneath, and as they work so vigorously they must in a very short time destroy many of these grubs.

J. MCEWEN.

SQUIRRELS.

The squirrel is one of the forester's greatest enemies amongst pine plantations in the north of Scotland. During last spring enormous damage was done by this animal to woods from 10 years up to 45 or 50 years' old, and so far as is known very little has been done of late on most estates to reduce the numbers of squirrels, although one estate has in the past year killed the enormous number of almost 4,000.

Foresters, however, in the north have at last realised the danger of allowing this pest to carry on without check. A squirrel club already exists for Ross-shire. In Moray and Nairn a squirrel club has recently been formed, from which it is hoped in a short time to have favourable

results. Estates in the County of Inverness are also proposing to form a similar club which will complete the organisation for the control of the pest in this group of counties. It is realised that in co-operation lies the only cure.

J. McEwen.

Insects.

Both Sitka and Norway spruce were severely attacked by *Myzaphis abietina* during the past season, but are now beginning to show recovery, particularly the Sitka. Many foresters had quite given up hope of these trees, and are now agreeably surprised to find them recovering. In the nursery at Monaughty a few Norway spruce were observed to be attacked, but an immediate spray of soft soap wiped out the colony, and the insect has not been seen again.

Weevils (*Hylobius abietis*) continue to give some trouble, and last year about 25,000 were collected by means of billet-traps on Monaughty and about 15,000 on Teindland. These billet-traps at the present time are found to contain a large number of *Hylobius* and *Pissodes* larvæ, and it is advisable that all traps should be burned by the month of May.

No other insects of importance were noted during the season except that again about 1,000 larvæ of the large Larch Sawfly were collected at Monaughty.

J. McEwen.

Bracken Cutting.

On Monaughty an extremely heavy crop of bracken was cut over twice during the summer of 1922. The soil was a good loam, and at once grass began to appear. In 1923 most of the bracken was again cut over early in the summer, the grass came up immediately, and now has the complete mastery over the bracken. From the grazing point of view this shows that bracken on land of this description could often be killed out in less than two seasons, and at a cost not exceeding 10*s*. per acre. On the other hand, from the forester's point of view, it is somewhat doubtful if it pays to exterminate bracken on such land, as the grass which appeared gave far more trouble than the bracken; heavy grass smothers plants much more than bracken, and is very much more expensive to cut. Weeding or cleaning of individual plants is necessary with grass, and it would appear that instead of exterminating bracken on good soil it might be better to hand clean with hooks the same as with grass.

J. McEwen.

Rabbit Extermination.

An expert trapper in Fifeshire was instructed to exterminate the horde of rabbits burrowed in an area enclosed by wire netting, previous to the commencement of planting operations. On the successful completion of the work, the trapper, with a serious expression, remarked,

" I've trapped and killed rabbits all my long life, but could never have believed it was such a difficult job catching the last one." These words emphasize the great difficulty experienced by foresters in combating the rabbit, which in most parts of Scotland is considered the foresters' most dangerous enemy. The writer, with a life experience of estate labour, knows of no successful short cut towards the complete extermination of this pest, which is an absolute necessity in a planting area where rabbits abound. Pheasants, Wood Pigeons, etc., can be caught in large numbers by catchers ; the long-net may be put to good use elsewhere, but, in the enclosed area, systematic and plodding perseverance by the trappers is demanded. With traps and snares they tackle the work, gradually lessening the numbers of rabbits and blocking burrows, until only a few open holes remain, each guarded by a trap. They, thereafter, with bag-net or gun, ferret every burrow where there is an unblocked hole, systematically closing up, with the use of the trapping spade, as they carefully plod over the ground. They realise that the most exacting part of their labour is at hand. A few rabbits may have refused to bolt or escaped worrying by the ferrets, and are endeavouring to burrow their way out of their closed holes. The trappers then scour the area in search of their elusive quarry which now cutely lie out in tufts of grass, heather, or any likely hiding place in the open—seemingly never moving from their clap, even for food. The trapper's dog, without which he is seriously handicapped, proves his worth in the last stage, and it really completes a most difficult undertaking. The gassing machine now on the market is a useful invention, but is only put to use in extreme cases. No revenue can be derived from this method of extermination. After the area has been successfully exterminated and the season's planting completed, one has no guarantee that he is free from the rabbit pest. By under-burrowing, climbing, jumping, squeezing through the meshes of netting, etc., the rabbit, in its search for new ground and greener grass, poaches its way into the forbidden area. Only by close observation near fences, etc., and regular inspection of the area, can one satisfy himself that the young plants will not be nipped.

With regard to the labour cost for this work of extermination it is admitted that a debit balance is incurred, but a trapper looks to his traps and snares in outside areas to counterbalance the loss, and the writer last year was in the position of showing a credit balance ; the sales of rabbits from the scheme, even with the high railway freights to market, giving a return which more than met the trapper's wages and other charges.

P. Clark.

Frost attacks on Sitka Spruce.

It appears to be important that due consideration should always be given to the effect which frost might have on young Sitka plants before deciding to plant this species in moist hollows, even where the general conditions point to its being " the right tree in the right place."

It may be said, of course, that Sitka spruce readily sends up a new " leader " or utilizes one of its side shoots for this purpose, and in fact,

this usually occurs when the leading shoot of, say, a newly planted 2 yr. 1 yr. Sitka has been "frosted."

If, however, the plant is again injured by frost in the following year the results seem to be much more disastrous, and this especially where the ground is covered by rough vegetation. In the first instance the young plant was able to form a new "leader" either by the conversion of a side shoot or, as is more often the case, from a lateral bud below the frosted portion of the original "leader." It has been noted, however, that in a great many cases this new "leader" appears to have no lateral buds, and in cases where there are such buds they are usually to be found near the apex of the leading shoot. Then if the plant is surrounded by rough vegetation (as is often the case on what appears to be suitable ground for Sitka) the new "leader" is very liable to be "drawn" and the remaining side branches are usually greatly weakened, if not practically killed. It is therefore evident that the effect of a second "frosting" on a plant in this condition will, in the majority of cases, prove fatal.

The advisability of planting Sitka spruce on ground with rough vegetation, and where the plants are likely to be subjected to regular annual frosts is therefore uncertain and, in any case, the regular clearing of the vegetation from immediately around the plant seems to be necessary to insure any degree of success.

J. A. MacAlpine.

The Empire Forestry Association.

The Empire Forestry Association which is under the Presidency of H.R.H. the Prince of Wales, was incorporated by Royal Charter in 1921. It is a voluntary organisation formed in order to promote the interests of forestry and the commercial utilisation of forest products. It provides a means of communicating between all concerned in economic development of forest lands throughout the Empire, and its membership is open to all interested in forestry. A magazine, "The Empire Forestry Journal" (edited by Mr. Fraser Story), which is issued free to members of the Association, is published twice yearly for the discussion of matters relative to forestry and for the circulation of information regarding timber supply and forest management.

The affairs of the Association are directed by a Governing Council representative of all parts of the British Empire. The annual subscription for ordinary members is £2; for associate-members £1. Affiliated members pay an agreed sum annually and the life membership fee is £30. (A resolution will be submitted at the next Annual General Meeting which, if approved, will enable members of the Forestry Services of the Empire to become members of the Association on payment of the reduced subscription of ten shillings annually.)

The Secretary of the Association is Mr. J. S. Corbett, Imperial Institute, London, S.W.7.

REGISTER OF IDENTIFICATION NUMBERS.

Forest Year 1923.

The order of arrangement is as follows :—

Serial number (preceded by the last two numbers of the forest year in which supplies were received); quantity; species; crop year; origin; vendor.

23/1 8 lbs.; *Pinus laricio* var. *Calabrica*; 1922; Italy (Calabria); Italian Government.

23/2 1,007 lbs.; *Larix europaea;* 1922; Italian Tyrol; J. J. Roner.

23/3 175 lbs.; *Picea excelsa*; 1922; Italian Tyrol; J. J. Roner.

23/4 962 lbs.; *Larix europaea;* 1922; Italy (reputed Pusterthal); A. Grunwald.

23/5 197 lbs.; *Picea excelsa;* 1922; Presumed Italy (Tyrol); A. Grunwald.

23/6 640 lbs.; *Pinus laricio;* 1922; Corsica; O. J. Rossi.

23/7 433 lbs.; *Pinus laricio;* 1922; Corsica; P. Spinosi.

23/8 40¾ lbs.; *Larix europaea;* 1922; Silesia (Liebenthal); A. Gebauer.

23/9 ¼ lb.; *Tsuga Canadensis;* 1922; U.S.A.; T. J. Lane.

23/10 ¼ lb.; *Pinus strobus;* 1922; U.S.A.; T. J. Lane.

23/11 ¼ lb.; *Pseudotsuga Douglasii;* 1922; U.S.A. (Colorado); T. J. Lane.

23/12 1 lb.; *Pinus Jeffreyi*; 1922; U.S.A.; T. J. Lane.

23/13 1 lb.; *Cupressus sempervirens;* 1922; U.S.A.; T. J. Lane.

23/14 1 lb.; *Cupressus macrocarpa*; 1922; U.S.A.; T. J. Lane.

23/15 4 lbs.; *Picea alba;* 1922; U.S.A.; T. J. Lane.

23/16 5 lbs.; *Sequoia sempervirens;* 1922; U.S.A.; T. J. Lane.

23/17 59 lbs.; *Pinus maritima;* 1922; France (Landes); Vilmorin-Andrieux.

23/18 56¾ lbs.; *Larix europaea;* 1922; France (Embrun forest, Gap, altitude 5,000 feet); French Forestry Service.

23/19 73 lbs.; *Fagus sylvatica;* 1922; England (School Division); own collection.

23/20 28 lbs.; *Fraxinus excelsior*; 1922; England (School Division); own collection.

23/21 7 lbs.; *Acer pseudoplatanus;* 1922; England (School Division; own collection.

23/22 17 lbs.; *Pinus montana* var. *pumilio;* 1922; Italy (Tyrol); Wallpach Schwanenfeld.

23/23 638 lbs.; *Pinus laricio;* 1922; Corsica; J. Pantalacci.

23/24 6 lbs.; *Pinus ponderosa;* 1922; U.S.A.; T. J. Lane.

23/25 500 lbs.; *Pinus laricio;* 1922; Corsica; J. Grimaldi.

23/26 41 lbs.; *Abies nobilis;* 1922; Scotland; D. W. Smith.

23/27 55 lbs.; *Pinus montana* var. *uncinata;* 1922; Denmark; J. Rafn.

23/28 12 lbs.; *Hippophae rhamnoides;* 1922; origin unknown. J. Rafn.

23/29 1 lb.; *Pinus Thunbergii;* 1922; origin unknown; J. Rafn.

23/30 435¾ lbs.; *Pinus laricio;* 1922; Corsica; O. J. Rossi.
23/31 232¾ lbs.; *Pinus laricio;* 1922; Corsica; J. Grimaldi.
23/32 501 lbs.; *Larix europaea;* 1922; Italian Tyrol; J. J. Roner.
23/33 214 lbs.; *Pinus laricio;* 1922; Corsica; O. J. Rossi.
23/34 211 lbs.; *Pinus laricio;* 1922; Corsica; P. Spinosi.
23/35 37½ lbs.; *Pinus maritima;* 1922; France (Landes); Vilmorin-Andrieux.
23/36 22 lbs.; *Pinus montana* var. *pumilio;* 1922; Italy (Tyrol); Wallpach-Schwanenfeld.
23/37 468 lbs.; *Picea sitchensis;* 1922; U.S.A.; Gift from American Forestry Association.
23/38 575 lbs.; *Larix europaea;* 1922; Italian Tyrol; J. J. Roner.
23/39 3,079 lbs.; *Fagus sylvatica;* 1922; England (New Forest); own collection.
23/40 350 lbs.; *Fagus sylvatica;* 1922; England (Bere); own collection.
23/41 325 lbs.; *Fagus sylvatica;* 1922; England (Parkhurst); own collection.
23/42 2,520 lbs.; *Fagus sylvatica;* 1922; England (Dean Forest); own collection.
23/43 7 lbs.; *Fagus sylvatica;* 1922; England (Ampthill); own collection.
23/44 672 lbs.; *Fagus sylvatica;* 1922; England (Salcey); own collection.
23/45 56 lbs.; *Fagus sylvatica;* 1922; England (Allerston); own collection.
23/46 418 lbs.; *Fagus sylvatica;* 1922; England (Brackley); own collection.
23/47 42 lbs.; *Fagus sylvatica;* 1922; England (Swaffham); own collection.
23/48 310 lbs.; *Fagus sylvatica;* 1922; England (Cannock); own collection.
23/49 60 lbs.; *Fagus sylvatica;* 1922; Wales (Gwydyr); own collection.
23/50 20 lbs.; *Fagus sylvatica;* 1922; Wales (Vaughan); own collection.
23/51 518 lbs.; *Fagus sylvatica;* 1922; England (Tintern); own collection.
23/52 50 lbs.; *Fagus sylvatica;* 1922; England (Eggesford); own collection.
23/53 50 lbs.; *Fagus sylvatica;* 1922; England (Halwill); own collection.
23/54 60 lbs.; *Fagus sylvatica;* 1922; England (Haldon); own collection.
23/55 75 lbs.; *Fagus sylvatica;* 1922; England (Bodmin); own collection.
23/56 100 lbs.; *Fagus sylvatica;* 1922; England (Exmoor); own collection.
23/57 150 lbs.; *Fagus sylvatica;* 1922; England (Quantocks); own collection.

23/58 ; 75 lbs. ; *Fagus sylvatica ;* 1922 ; England (Alice Holt) ; own collection.

23/59 61 lbs. ; *Fagus sylvatica ;* 1922 ; England (Woolmer) ; own collection.

23/60 130 lbs. ; *Fagus sylvatica ;* 1922 ; England (Chiddingfold) ; own collection.

23/61 148 lbs. ; *Fagus sylvatica ;* 1922 ; England (Elvedon) ; own collection.

23/62 441 lbs. ; *Fagus sylvatica ;* 1922 ; England (Bramshill) ; own collection.

23/63 231 lbs. ; *Fagus sylvatica ;* 1922 ; England (Rushford) ; own collection.

23/64 100 lbs. ; *Fagus sylvatica ;* 1922 ; England (Culford) ; own collection.

23/65 353 lbs. ; *Fagus sylvatica ;* 1922 ; England (Hengrave) ; own collection.

23/66 9 lbs. ; *Fagus sylvatica ;* 1922 ; England (Downham) ; own collection.

23/67 80 lbs. ; *Fagus sylvatica ;* 1922 ; England (Tring) ; own collection.

23/68 668 lbs. ; *Fagus sylvatica ;* 1922 ; England (Great Abington) ; own collection.

23/69 318 lbs. ; *Fagus sylvatica ;* 1922 ; England (Babraham) ; own collection.

23/70 403 lbs. ; *Fagus sylvatica ;* 1922 ; England (Guildford) ; own collection.

23/71 112 lbs. ; *Fagus sylvatica ;* 1922 ; England (West Dean) ; own collection.

23/72 700 lbs. ; *Fagus sylvatica ;* 1922 ; England (Paddockhurst) ; own collection.

23/73 100 lbs. ; *Quercus sessiliflora ;* 1922 ; England (Parkhurst) ; own collection.

23/74 887 lbs. ; *Quercus sessiliflora* and *Quercus pedunculata ;* 1922 ; England (Dean Forest) ; own collection.

23/75 75 lbs. ; *Quercus pedunculata ;* 1922 ; England (Brackley) ; own collection.

23/76 1,900 lbs. ; *Quercus pedunculata* and *Quercus sessiliflora ;* 1922 ; England (Swaffham) ; own collection.

23/77 60 lbs. ; *Quercus sessiliflora ;* 1922 ; Wales (Gwydyr) ; own collection.

23/78 316 lbs. ; *Quercus sessiliflora* and *Quercus pedunculata ;* 1922 ; England (Dymock) ; own collection.

23/79 240 lbs. ; *Quercus sessiliflora* and *Quercus pedunculata ;* 1922 ; England (Exmoor) ; own collection.

23/80 772 lbs. ; *Quercus pedunculata ;* 1922 ; England (Alice Holt) ; own collection.

23/81 713 lbs. ; *Quercus pedunculata ;* 1922 ; England (Woolmer) ; own collection.

23/82 1,365 lbs. ; *Quercus pedunculata ;* 1922 ; England (North Chapel) ; own collection.

23/83 4,970 lbs.; *Quercus pedunculata;* 1922; England (Chiddingfold); own collection.
23/84 50 lbs.; *Quercus pedunculata;* 1922; England (Corner Farm); own collection.
23/85 443 lbs.; *Quercus pedunculata;* 1922; England (Bramshill); own collection.
23/86 5 lbs.; *Quercus pedunculata;* 1922; England (Rushford); own collection.
23/87 60 lbs.; *Quercus pedunculata;* 1922; England (Hengrave); own collection.
23/88 194 lbs.; *Quercus pedunculata;* 1922; England (Guildford); own collection.
23/89 4 lbs.; *Acer pseudoplatanus;* 1922; England (Dean Forest); own collection.
23/90 300 lbs.; *Acer pseudoplatanus;* 1922; England (Salcey); own collection.
23/91 20 lbs.; *Acer pseudoplatanus;* 1922; Wales (Gwydyr); own collection.
23/92 144 lbs.; *Acer pseudoplatanus;* 1922; England (Tintern); own collection.
23/93 50 lbs.; *Acer pseudoplatanus;* 1922; England (Alice Holt); own collection.
23/94 112 lbs.; *Carpinus betulus;* 1922; England (Dean Forest); own collection.
23/95 40 lbs.; *Carpinus betulus;* 1922; England (Rushford); own collection.
23/96 21 lbs.; *Alnus glutinosa;* 1922; England (Allerston); own collection.
23/97 147 lbs.; *Fraxinus excelsior;* 1922; Wales (Gwydyr); own collection.
23/98 10 lbs.; *Fraxinus excelsior;* 1922; England (Eggesford); own collection.
23/99 200 lbs.; *Fraxinus excelsior;* 1922; England (Alice Holt); own collection.
23/100 23 lbs.; *Picea excelsa;* 1922; Italy (Tyrol: medium altitude); J. J. Roner.
23/101 52¼ lbs.; *Pinus sylvestris;* 1921; Scotland (Deeside); extracted Seaton, 1923.
23/102 6¼ lbs.; *Pinus sylvestris;* 1921; Scotland (Deeside, Glentanar); extracted Seaton, 1923.
23/103 144¼ lbs.; *Pinus sylvestris;* 1921; Scotland (Lower Morayshire); extracted Seaton, 1923.
23/104 64 lbs.; *Pinus sylvestris;* 1921; Scotland (Upper Speyside); extracted Seaton, 1923.
23/105 35 lbs.; *Pinus sylvestris;* 1922; Scotland (Lower Morayshire); extracted Seaton, 1923.
23/106 4 lbs.; *Pinus sylvestris;* 1922; Scotland (Upper Speyside); extracted Seaton, 1923.
23/107 22 lbs.; *Pinus sylvestris;* 1921–22; Scotland (Altyre); extracted Aberdeen.

23/108 3 lbs.; *Pinus sylvestris;* 1921–22; Scotland (Altyre); extracted Aberdeen.

23/109 1¾ lbs.; *Larix europaea;* 1922; Scotland (Lower Morayshire); extracted Seaton, 1923.

23/110 4 lbs.; *Larix leptolepis;* 1921; Japan; Howden & Co., Inverness.

23/111 529 lbs.; *Fagus sylvaticus;* 1922; Scotland (Kincardine, E.); cleaned Seaton, 1923.

23/112 146 lbs.; *Fagus sylvaticus;* 1922; Scotland (Kincardine, W.); cleaned Seaton, 1923.

23/113 286 lbs.; *Fagus sylvaticus;* 1922; Scotland (Monaughty, Upper Elgin); cleaned Seaton and Monaughty.

23/114 700 lbs.; *Fagus sylvaticus;* 1922; Scotland (Craibstone, Aberdeen); cleaned Craibstone.

23/115 377 lbs.; *Fagus sylvaticus;* 1922; Scotland (Beauly); cleaned Beauly.

23/116 294 lbs.; *Fagus sylvaticus;* 1922; Scotland (Invergordon).

23/117 40 lbs.; *Acer pseudoplatanus;* 1922; Scotland (Craibstone, Aberdeen); cleaned Craibstone.

23/118 20 lbs.; *Acer pseudoplatanus;* 1922; Scotland (Beauly); cleaned Beauly.

23/119 40 lbs.; *Acer platanoides;* 1922; Scotland (Beauly); cleaned Beauly.

23/120 10 lbs.; *Fraxinus excelsior;* 1922; Scotland (Beauly); cleaned Beauly.

23/121 368 lbs.; *Fagus sylvaticus;* 1922; Scotland (Tulliallan); cleaned Tulliallan.

23/122 9,000 transplants (2 + 1); *Pinus montana* var. *pumilio;* crop year unknown; origin unknown; Howden & Co., Inverness.

23/123 200,000 Transplants (2 + 1); *Pinus sylvestris;* crop year unknown; origin unknown; Smith & Meldrum, Forfar.

23/124 38,000 Transplants (2 + 1); *Pinus sylvestris;* crop year unknown; Scotland (Morayshire); T. & W. Christie, Forres.

23/125 22,000 Transplants (2 + 1); *Pinus sylvestris;* crop year unknown; Scotland (Morayshire); T. & W. Christie, Forres.

23/126 2,000 Transplants (2 + 1); *Pinus montana;* reputed var. *uncinata* 1919; Germany; Howden & Co., Inverness.

23/127 5 lbs.; *Pseudotsuga Douglassii;* 1922; Scotland (Durris); Durris Estate.

23/128 1 lb.; *Picea sitchensis;* 1922; Scotland (Durris); Gift from Durris Estate.

23/129 1 lb.; *Abies grandis;* 1922; Scotland (Durris); Gift from Durris Estate.

23/130 21 lbs.; *Pinus sylvestris;* 1921; Scotland (Altyre); extracted at Tulliallan.

23/131 6 lbs.; *Pinus sylvestris;* 1922; Scotland (Calbumic); extracted at Tulliallan.

23/132 4 lbs.; *Pinus sylvestris;* 1922; Scotland (Paisley Wood); extracted at Tulliallan.

23/133 19 lbs.; *Pinus sylvestris;* 1922; Scotland (Tentsmuir); extracted at Tulliallan.
23/134 1 lb.; *Abies nobilis* var. *glauca;* 1922; Scotland (Montrave); extracted at Montrave.
23/135 4 lbs.; *Quercus sessiliflora;* 1922; France; Gift.
23/136 2 lbs.; *Larix leptolepis;* 1922; Scotland (Glentress); extracted at Tulliallan.
23/137 1 lb.; *Abies amabilis;* 1922; Scotland (Montrave); extracted at Montrave.
23/138 16 lbs.; *Fraxinus excelsior;* 1922; Scotland (Tulliallan); cleaned at Tulliallan.

LIST OF TECHNICAL STAFF.

CHANGES SINCE LAST ISSUE.

The following changes have occurred in the list of staff published in the last issue of the Journal :—

England and Wales.

Mr. H. A. Pritchard has become Assistant Commissioner for England and Wales.

The forester's school at Chopwell has been closed (temporarily) since the summer of 1923.

Scotland.

Mr. J. Cameron has rejoined the staff of the Board of Agriculture for Scotland.

Mr. M. L. Anderson has been graded as a District Officer.

FORESTERS.

Name and Address.	*Grade.*	*Forest.*
	England and Wales.	
Division 1.		
Meldrum, J. A. K., Jessamine Villas, Thornton Dale, Yorks.	I	Allerston.
Division 2.		
Williams, J., Dolafon, Llanrwst, Denbighshire.	I	Gwydyr.
Clark, J. S., Gipsey Green, Teddesley, Penkridge, Stafford.	II ..	Cannock Chase.
Price, A., Dolforgan Villa, Kerry, Newtown.	II ..	Kerry.
Harrison, P. M., Castle View, Wigmore, Kingsland, Leominster	II Temp.	Shobdon.