will be so far distant. As our population increases our requirements become greater, and if within the next 20 or 25 years we have a million people in Western Australia, then we will be up against it pretty hard.

The Conservator of Forests will have to answer to the general public as to whether he has done the best thing in their interest. You are a person not to be moved by public criticism. I want to give you my assurance that although you may make mistakes, you can always depend that, as far as I am concerned, as your Minister, I will always defend and support you in your work. If a man is only prepared to support you when you are right, you do not want his support. You will get hard up against it at times, but in your Conservator you will find a man ready to give you support and defend you against those who malign you.

The Minister then withdrew to fulfil other important engagements.

Mr. KESSELL: You have all had the Agenda Paper and have an idea of the papers and addresses that are to be delivered. Most of the points I want to make can remain until they come up as subjects of the various papers. Forest practice has slowly developed since 1918 when the Forests Act became law. The one great setback that forestry has suffered in this State is the loss of Mr. Lane Poole, to whom the credit for practically all the work that has been accomplished up to the present time has to be given. The foundation that had to be laid in a country like this, where there has been no forestry work and unrestricted cutting for many years, was tremendous, and the groundwork he accomplished is the basis of the work we are doing to-day. Our general administration known as "District work" and the associated patrolling is for the most part very efficiently carried out. Timber inspection is well organised. Although improvements can always be effected in any system there is not a great deal of worry associated with those branches. Reforestation work is still in its infancy, consequently it needs nursing by everyone. As the Minister pointed out, there must be mistakes made. It is all right to talk and discuss the mistakes within the Department. We want to know what you consider a mistake and how it should be remedied. If you do not agree with anything, you should have an idea or some alternative method of overcoming the problem; and if so, your views will receive sympathetic consideration.

The basis of all forestry in the State must be fire protection. Certain of you may not agree entirely with that. Of course, you are wrong although you may remain unconvinced. Even those who do not agree with the necessity for complete fire control must admit the necessity for controlled burning of the bush after fallers. The destruction of the standing timber is then evident, and Mr. Weston in his paper on "Top Disposal Operations" will explain how we propose to cope with that particular problem. It is necessary to fully protect the present crop, and there may be some who still maintain that there is a satisfactory regeneration developing in the bush. Looking at the existing regeneration collectively, it does not look so bad. There appear a nice lot of saplings with green tops, but if such are examined systematically few sound ones are found. In attempting to thin out the present regrowth the trouble would be, not what to take out, but where to find saplings sufficiently sound to leave.

We have particular problems of silviculture in this country owing to difficult climatic conditions. We have a fairly certain winter rainfall, but we have at the same time five or six very dry months, which constitute our greatest problem in fire protection and silviculture; also, in afforestation, because we are limited in the trees which it is possible to introduce into this country. A certain amount of softwood timber is essential. One preaches the use of karri and jarrah, but there are uses for softwoods for which our local timbers are not as well suited. We are importing some £140,000 worth of softwoods at the present time. The trees to be planted to supply this need must come from climates that are more or less similar to ours.

Arboriculture, although not altogether a function of this Department, is important, and we may all do a great deal to help in the country districts. Farmers need encouragement to start small plantations or reserve wood lots for their own use. Councils and Road Boards are keen enough in planting their trees in many districts, but if the tree does manage to get above the tree-guard they spend the rest of their funds cutting its head off year after year because they originally planted it under a telephone line. In such cases foresters can do a great deal to influence public opinion.

The elimination of waste in the bush is a matter which, as far as existing operations are concerned, you are in a position to materially assist; but we require the assistance of the scientific investigator to show the economic possibility of working up the material which is left lying in the bush. For instance, in karri bark there is quite a high percentage of tannin, viz., 17 per cent. In tuart timber there is 12 per cent., and England is paying a very high price for wood containing 5 per cent. All these materials should be utilised. We have fought hard for the Forests Products Laboratory, and have not given up hope of a live institution being established in this State.

I regard the discussion on the papers as a very important feature of the conference, and I hope anyone who has anything to say in regard to them will do so at the conference, and not wait until afterwards. I will now ask Mr. Stoate to read his paper.

Paper by Mr. T. N. Stoate—"The Silvicultural Treatment of Jarrah Forests."

Forestry, like every other productive industry, is a business, and therefore in handling a forest or series of forests we can distinguish two separate, yet necessarily always closely inter-dependent branches, namely, the production of the timber and the disposal of it.

The Department is responsible for establishing and protecting the trees, because the present generation may derive no benefit from the work. The disposal of the crop is left to private enterprise, but we must supervise this disposal, since the conduct of the silvicultural work is influenced largely by the manner in which the bush is exploited.

As in every other business, it is imperative that the markets are fostered by seeing that the required type of produce is delivered to the buyer. At the same time, however, the disposal of as much as possible of all classes of mature timber is very necessary, and that this may be achieved the product delivered must be of the minimum quality that the purchaser will take.

The Inspection Branch fulfils the important service of maintaining the balance for the Department, as producer, between the buyer and seller, thus interpreting the buyer's specifications to the best advantage of the forest.

It will be readily understood that the way in which the bush is worked by the sawmiller is influenced greatly by conditions prevailing in regard to density of population and markets.

In Western Australia there are established trade practices, and a very large capital is invested in the industry. Consequently these established methods of working determine to a large extent the silvicultural operations which are economically possible.

If conditions here were as in some other countries where forest management has been practised over long periods, and density of population has rendered a closer utilisation of all kinds and classes of wood possible, the treatment which would be followed, to achieve the best results for a light-demanding species like jarrah, would be clear-felling, followed by even-aged crops. This means that the whole of the timber standing on a specified area of forest may be sold each year without restriction as to girth, method of felling, or cleaning up, making the supervision of the bush of minor consequence. But in Western Australia for the present we are compelled, through force of circumstances, to adopt less intensive methods, and the system, selection by groups, is clearly indicated.

Once having decided upon the provisional treatment to be followed, the success of the work depends, to a large degree, on the manner in which the removal of the timber is controlled, for the immature trees are mixed with the mature trees, and consequently the room for improper practices, which would not only hinder the work of regeneration but cause serious injury to the young growing stock, becomes immeasurably great.

One of the most salient features in the form of control we exercise is the Minimum Girth Restriction. This is not an ideal feature, but merely a matter of practicability for the time, and its weakness is readily recognisable. As a temporary measure, however, it does succeed in saving a certain amount of immature timber, as an inspection of the cut-over jarrah bush shows.

In any system of forest management that may be laid down, the determination of the amount that can be harvested every year for ever, or regulation of the cut, is of prime importance. This can be readily understood when viewing an isolated area which is to supply timber for a constant local demand. The harvesting of the mature produce must be so regulated that a certain specified area must be cut every year, or equal period of years, in order that a supply may be maintained for all time, and, as each area is cut out, it would be re-stocked with a new crop.

However, this is a question that need not cause particular worry to-day in any one division of the jarrah bush. The amount of timber being cut is far in excess of what can be maintained for all time. Consequently, even if regeneration work is commenced immediately, there must intervene a period of lean years between the time the last of the present crop is cut and the time when the new crop, that the regeneration operations are responsible for, is ready.

Most of the jarrah bush is in an abnormal condition, and until the whole of it can be improved to a state more or less normal, regulation of the cut will not be of any great consequence as far as silvicultural work is concerned. The only way in which the cut can be regulated whilst the forest is abnormal is a reduction in the rate of cutting, and this is one of the reasons that justifies the restriction of hewing. The large amount of money already expended in the erection of sawmilling plants precludes the possibility of doing anything in the direction of limiting the sawn output, even if this were desired.

Natural regeneration.—In order to bring about regeneration of the jarrah bush many people say that all that is necessary is to allow the sawmiller to cut what he wants, and leave the rest to nature. That is not so. The fallacy of such a belief is readily understood when we realise that in the operations of the sawmiller the over-mature and worthless trees are not removed, but are allowed to remain to occupy ground which might be supporting valuable new growth. Also, only the valuable kinds are cut, leaving the useless species, such as marri, banksia, oak, etc., in stronger possession than before. Promising groups of piles and poles which are left are often over-topped and spoilt in their growth by worthless trees.

It is seen, therefore, that in the exploitation of the bush here, as in all newly developed and developing countries, the timber-getter, in his work of removing the valuable portions of the growth, does not go far enough to ensure adequate reproduction, and so his methods become unsatisfactory if unaided. We must remedy this by supplementing his work by removing all that tends to hinder the development of a new crop.

It has been shown that the simplest way to attain our object would be to start at one end of the forest, and, working behind the "faller," clear-fell an equal portion each year. But, in addition to the difficulty of persuading the sawmiller to work in any particular place or direction, the clear-felling of any extensive area of jarrah bush to-day would necessitate the sacrifice of many immature and promising trees; also the retaining, at the far end of the forest, many trees which are mature and in need of cutting at the commencement, and which should be replaced by a new crop as quickly as possible. Moreover, the felling of young trees always results in heavy coppice, often to the exclusion of seedling growth.

An exception occurs where there is a demand for the young timber that must be cut and where the resulting coppice growth will supply the local needs, as in the case of a mining district. Here it is possible to employ the clear-felling system, and this system is adopted by this Department on the Coal Mining Leases at Collie.

Cutters are allowed to work up and remove all trees suitable for mining purposes, irrespective of size or species, and crooked or windy trees of any value which remain are cut for mill logs. By this means all useful trees are utilised. The departmental employees then carry out regeneration cleaning, which consists of the felling of everything below 12in. D.B.H. (Diameter Breast Height), and the ringbarking of the remainder. The stand which results is seedling with coppice forest: but there the main object is to meet the demand of the Mining Companies, and coppice growth will supply that demand.

The time of this ringbarking is of paramount importance, for everything on the area is killed. Con-

sequently, if regeneration does not result, there are no seed trees left, and the expense of artificial sowing may become necessary.

Matters on which officers should be able to gather valuable information are: the relation of the time of ringbarking to flowering, fruiting, and shedding of seed, and the results obtainable from regeneration operations on burnt and unburnt country. Should we ringbark when the buds are forming, when the flower opens, when the seed is about to fall, or not until the seed is in the ground? The relation of burning to regeneration is a debatable question. Is the supposed beneficial effect of burning more apparent than real? That is to say, are the seedlings merely more easily seen on burnt country? Again, are those on unburnt country protected from the scorching effects of the long dry summer by the litter and debris; and do the seedlings which appear on the burnt country merely shrivel up later and disappear? On the other hand, is burning necessary in order that a good seed bed shall be provided; or may it be required in order to "kill back" shrubs for a short period, and thus reduce moisture competition in the very early stages of the life of the seedlings?

An important feature in the control of the exploitation at Collie is that cutters are restricted to coupes or fixed areas. The object of this is to ensure more thorough utilisation. This principle should be more fully applied in other parts of the country than has been the practice hitherto. By way of illustration, take 500 acres of jarrah bush, carrying three loads of sleepers to the acre. Then, if a permit over this block is secured by a man working with one team capable of carting 50 loads a month, he is allowed nearly three times the area of country he can thoroughly "cut-out" in the one year, the duration of the permit. Under these conditions the sleeper-cutter, to secure his output, will take only the best trees, making the remaining timber worth very much less per load by reason of this, when the block is again submitted for auction in the following year.

Having disposed of the particular case where we can apply a more or less ideal system, we come to the practical question at issue. For the major portion of the jarrah bush it has been decided, after a study of the condition of the forests, their silvicultural characteristics and trade requirements, that the best silvicultural system, or method of treatment, is selection by groups. This method is indicated by the fact that jarrah occurs in groups of even-aged trees in its natural state. When in the sapling stage, with the trees only a few inches apart, such a group is readily recognisable in the forest. In the pole stage, where the trees have a diameter of about 15 inches at breast-height, and have thinned out to a distance of from five to 10 feet apart, the group is still distinguishable. But later, when the trees have attained a girth of ninety inches, and are separated by distances of 20 to 40 feet, the boundaries of a group are much more difficult to define, yet nevertheless the group still exists. Often trees of a lesser girth, which appear to be a later crop, are found between and below the larger members. These are not a further crop, but are merely those left behind in the struggle for existence.

The Group Selection scheme consists of the formation of openings or blanks in the forest, by the removal for trade purposes of such mature produce as possesses market value, and the enlargement of the openings so formed by the destruction of over-mature and worthless trees adjoining. The faller removes the valuable portions of the mature growth when cutting for industrial requirements, and the Departmental employees subsequently carry out regeneration cleaning by ringbarking the adjacent useless trees. Ringbarking, of course, introduces an additional fire hazard, and particularly so when applied to marri, but where, as at Mundaring, close fire-protection has been instituted, ringbarking is considered to be a legitimate risk. Under those conditions then, and there only, it becomes merely a finance question, being cheaper than felling.

Further problems regarding which local officers can make observations are—the most advantageous size for the groups, the effect of side shade, the distance the seed will carry, and the advisability of leaving seed trees in the openings formed. The relation these factors bear to the encouragement or repression of marri is of outstanding importance.

The disposal of the debris and tops resulting from the felling is an integral part of the regeneration operations in the jarrah bush, but this is to form the subject for a separate paper at this conference.

Mr. STOATE: In conclusion, I would like to say that I have touched on as many points as possible, and have introduced many problems in the form of questions in order to promote discussion.

Mr. KESSELL: In view of the large amount of work that has been done under both silvicultural systems at Collie, I have asked Mr. Sharp if he would open the discussion.

Mr. SHARP said that they had not done much cutting under the group selection system at Collie, but in what they had done there had been a certain amount of difficulty in getting the men to realise the necessity for leaving seed trees. It was said that in the clear felling system all trees were ringbarked. All trees were not ringbarked at Collie until it was evident that there were sufficient seedlings on the area. The speaker said that on country that had been burnt over during November and December, up to January, there had been really good germination of jarrah seedlings, and also on adjoining country that had not been burnt. When out the other day making notes on the country and the difference in the seedlings, he found that all the seedlings on unburnt country had practically disappeared, and they were in all stages of being eaten by insects, whereas, on the burnt country adjoining, very few of the seedlings had been destroyed.

Mr. KESSELL said that on the burnt country they were likely to have more difficulty in getting through the summer.

Mr. SHARP agreed, and said it was a question which was the worse, the fires burning up the humus and litter, or, on the other hand, the insects destroying the seedlings. Proceeding, Mr. Sharp said he had taken some measurements on the clear felling system on one of the compartments on the Co-operative leases. There had been no fires whatever on it since the felling and regeneration cleaning.

The compartment was worked over in the latter part of 1920. The tops and the leaves the timber workers left lying on the area in 1920 were very hard to find to-day. During the regeneration of jarrah there were seedlings there, but they were not to be found now. Mr. Sharp gave figures for the rate of growth of two-year old jarrah coppice. One

area of from 50 to 60 acres of ironstone, sandy gravel country, contained 1,217 coppice shoots to the acre. There had been three times that number but that was all that remained after thinning. Some of them were 2in. to 3in. in diameter at breast height, and they averaged 20ft. to 25ft. height in the two years. But there were no seedlings whatever.

Mr. KESSELL: How does that rate of growth compare with marri?

Mr. SHARP: Marri beats jarrah. Of the 2in. to 3in. diameter from 21ft. to 25ft., there are 10 jarrah; of the 2in. to 3in. diameter 20ft. to 25ft. there are 70 marri. Altogether there are 1,217. At the present rate of growth, that will give us, in five or six years, 26 loads to the acre.

Mr. KESSELL: That rate of growth would slow down after the first few years.

Mr. McVICAR asked Mr. Sharp did he say he had no seedlings at all?

Mr. SHARP replied that they came up, but the insects destroyed them. This was purely coppice.

Mr. TURNER asked was it ever burnt?

Mr. SHARP replied No; no fires have been on the area. On country that had been burnt there were about 1,134 shoots of jarrah and marri to the acre, before thinning.

Mr. McCOY asked Mr. Sharp was he sure that the coppice was not stronger than the seedlings? It was quite possible that the coppice killed the seedlings.

Mr. SHARP said it was only during the last few months that the seedlings had disappeared. They had been eaten by caterpillars. He did not know the actual insect doing the damage, but there were various kinds in the bush.

Mr. McVICAR said, in dealing with the coppice and the seedlings, he took it they were speaking of the same area.

Mr. SHARP said Yes.

Mr. STOATE said he had apparently omitted the question of seed trees, and that was one of the questions on which we require information. Was it necessary to leave any seed trees, and, if so, what number to the acre? Trees with good crowns were at present being left for this purpose in all our silvicultural operations, both in the Group Selection System and Clear Felling System. The important point was that at Collie we were getting sufficient restocking from coppice growth, but that was not what we were aiming for in the major portion of the jarrah bush.

Mr. WESTON, dealing with the question of the manner in which the seedlings on burnt country would stand the summer, said that, particularly in the karri and the tuart forest, the splendid manner in which the seedlings stood the summer where the crown of the fallen tree had been burnt and the ground severely scorched and the seedlings exposed to the sun, was very noticeable in those circumstances, and he thought, therefore, where the jarrah seedlings were entirely exposed to the sun and heat, owing to bush fires having previously burnt the debris and litter, there would be no doubt about such seedlings thriving.

Mr. KESSELL asked was Mr. Weston allowing for the ash, which formed a fine seed bed? Mr. Weston appeared to be comparing a bed of ashes to a hard-baked ironstone.

Mr. WESTON said he had given an example that could be frequently seen at any rate. Dealing with the action of insect pests, when fire protection is instituted, the speaker said that our entomologists told us that these insect pests work in cycles and that the natural parasite would prey on the insect pest in the course of time. It remained to be seen how long it would take before their natural enemy got to work with them. He had noticed often that these insect pests seemed to be more prevalent where the country had not been burnt; in a lot of cases, there was an obvious reason. In the tuart country, for instance, there was the haplonyxtibialis that cut the buds. The grub lived in the bud on the ground for many months, and, in the circumstances that prevailed before fire protection was instituted, the fire came through and killed out a number of these insects. There was a big chance that those insect pests would multiply when one of their enemies—fire—ceased to exist, though other insects might kill them. The result might apply to the area Mr. Sharp had mentioned where the insects were beginning to work on the country that had not been burnt.

Mr. McCOY said photographs had been taken some years ago of a piece of country near Holyoake. These were taken for the purpose of showing destruction by heavy fire in the jarrah bush. There was a regrowth since grown there, which showed that jarrah would grow well in heavily burnt country whether exposed or not.

Mr. SMITH said that in connection with the effect of fire after regeneration, he would like to be sure whether that growth now was seedling or coppice. At Mundaring the growth, originally seedlings, had been burnt many times and there were not 5 per cent. of seedlings there now.

Mr. McCOY said a big proportion of the regrowth he spoke of was seedlings, not coppice.

Mr. KESSELL said that in the ring-barking of 20,000 acres of timber at Mundaring no attention had been paid to the leaving of seed trees. The extent of the country ring-barked showed that the work had taken many months. The season evidently had had no effect there. Heavy fire went through the area after the ring-barking, and practically the whole of the prolific regrowth was jarrah.

Mr. McVICAR said that in the discussion on Mr. Stoate's paper they had got on to the burning question right along, and had missed some very vital points. Dealing with the amount of timber that our forest was making, the speaker said we laid out our sample plots in various districts, under Mr. Lane-Poole's instructions, to get accurate data as to what our forest was really making per acre and per annum. At the second measurement of these blocks a great many of the trees had disappeared altogether, but, nevertheless, we were able to get some approximate figures, and it was found that our forest was making 250,000 loads a year. Against that we found that we were cutting out 800,000 loads per annum. Consequently, with only 400,000 acres of virgin jarrah to work upon (speaking now of three years ago), our forest asset of merchantable timber was very soon going to be a thing of the past so far as export was concerned at any rate. The vital question was how to regenerate these forests. There had been interesting arguments about fire, and the result of fires on the germination of the seed. There were different opinions held by almost every man in the bush as

regards fire. Personally, he believed that the fire helped to germinate the seed.

It was said that the fire simply made a good seed bed of potash, and the seed germinated more rapidly in that potash than it would do on the hard-baked ground. Mr. McVicar recounted an experiment he had carried out himself. He took two thicknesses of envelope, and put some jarrah seed into them. He set one envelope alight and sowed that seed in one box, and took other jarrah seed that he had not touched in any way by fire and sowed it in another bed. From the seed that had gone through the fire he got a good germination, and from the other seed he got scarcely any germination.

Mr. McVICAR said that protecting our forests from fire did not mean that we were absolutely going to prevent all fires, but that all fires would be controlled fires.

He thought that if we put fire through and then protected the area after a good seed year, instead of getting a mass of coppice we would get a mass of seedlings that would come to maturity and restock our forests.

Mr. McVICAR referred to Mr. Stoate's remarks on the ringing of the redgum and other useless timber. Was the redgum useless timber? Many of our commodities and many of the things of the world that were considered useless a few years ago were to-day articles of commerce.

The question of redgum was important, because we had a leather chemist out from England in connection with the Forest Products Laboratory for two years to investigate the decolourising of the kino that we get from the redgum. With that decolourisation he thought that we had a first-class merchantable article in our redgum, and we had a better article in our redgum than we had in our imported barks, or in our other tanning barks, because with the redgum tree we could simply tap or scrape the bark to get the kino and yet leave the tree alive, whereas with the mallet bark and the wattles the tree was killed by getting the kino.

Mr. KESSELL said there were one or two points he would like to comment on after Mr. McVicar's remarks. The first was in connection with the heating of the seed by burning in order to secure quicker germination. We regularly gathered seed, sent it down to Hamel where it was taken out of the seed case and sown, and our germination there was very satisfactory. We never had recourse to any burning or heating in connection with eucalypt seeds.

Mr. SMITH said the point was, whether the seed was out of the seed vessel or not.

In all cases the seed did not drop from the seed vessel. The seed vessel itself did not drop, and it was possible that where a particular tree was felled before the seed was entirely ripe, the seed vessels might not open. The difference between a fallen tree and a standing tree was that we did not heat the seed vessels to get the seed out in the latter case.

Mr. DONOVAN said he had tried an experiment on tuart seed down at Jarrahwood. He had about 1 oz. of seed, half of which he steeped in boiling water, and they germinated. The other half were not treated in any way and they did not germinate at all.

Mr. McVICAR said that five or six years ago on the tuart plantation he noticed that a big tree had been felled, the log taken, and the debris burnt. On the site where the fallen tree-top had lain the ground was covered with seedlings. As an experiment he ran a light fire under some standing tuart, but no seedling growth resulted.

Mr. KESSELL said interesting results had been arrived at in connection with regeneration of tuart. It seemed that there was no germination except in heavy seed years except where seed fell on ashes. The theory was that the seed fell after the ashes had formed and that the ants were unable to walk on the ashes, and consequently the seed was left to germinate; whereas if it had fallen on the surrounding soil it would have been carted off by ants.

Mr. SMITH said that at Mundaring some silvicultural operations were carried out about two years ago on several compartments of from 400 to 500 acres on the group selection system. He carefully noted results, and there was practically no germination, except in little clumps. He thought the whole cause of the matter was that the tops littered the ground. But there was a certain amount of regeneration, and the seedlings looked well and would probably grow. The conclusion that he had come to was that the silvicultural work was probably wrong. He thought that we should have to regenerate on the group selection system, and that it would be best to put a fire in at night. A good clean burn could be obtained at night, and it would not affect any small young seedlings. The fire would be severe enough to clean up the ground, and he would advocate that next year experiments be carried out on these lines. The bush could be ringbarked at the end of the winter, and by the end of the summer we could clean it up and await results.

Mr. GARDNER said he certainly thought that regeneration results were considerably higher after a fire. This was not due to the action of the fire on the seed, because fire destroyed seed. When a fire went through, it caused a large fall through the opening of the seed vessels on the trees. There was no doubt that in forests such as the Eastern District and the goldfields forests the regeneration was very much greater after a fire had been through the bush. Fire prepared the seed bed; it also gave greater light spaces, and destroyed parasites on the ground which fed on seed. Ants caused a considerable amount of jarrah forest to be lost by carrying away seed. He had seen ants—a certain large red ant—with their nests full of jarrah seeds.

Mr. DONOVAN said that, speaking of the regrowth of jarrah, he had come to the conclusion that it grew a lot faster than we thought it did. He based his remarks on what he had seen in the Margaret River railway country. Between 40 and 50 years ago that country was cut out clean by Mr. Yelverton, and it was now carrying from six to seven loads to the acre. Thirty thousand sleepers had been cut from about 2,500 acres recently for the Margaret River railway.

Mr. KESSELL asked had that been burnt regularly?

Mr. DONOVAN replied: It had been burnt just the same as other country.

Mr. STOATE, replying to questions raised, said that he thought the regeneration of jarrah bush was a very simple matter, for examples of it might be seen anywhere in the jarrah country where heavy cutting operations for trade purposes had been carried out. He was quite sure we were going to get jarrah and very little redgum after our silvicultural operations, because you could see this result anywhere in the good jarrah areas to-day. He agreed with Mr. Smith that it was a matter of ordinary common sense that, once regeneration was secured, it must, at least in its early stages, be protected from fire at all costs. The question of marri being a use-

less timber to-day, and possibly of value in the future, was a very important one. He felt quite sure that redgum would be useful in a few years' time; but we knew this: that, in other than mining districts, the redgum to-day was worthless, and we ringbarked the occasional redgum so that in 20 years' time we would have a growth of jarrah which we were certain would be valuable. In the exceptional case, where there were a number of sound redgums together, we left them; for there it was likely that marri would occur in greater numbers than jarrah in the regrowth that would follow the ringbarking of these trees. Moreover, owing to the large extent of jarrah country to be dealt with, the small groups of pure, or almost pure marri, could economically be left untouched.

Mr. KESSELL said Mr. McVicar also raised the point of the value of the marri kino for tanning purposes. Some three years ago he (Mr. Kessell) had done some research work on the origin of the gum. He was perfectly satisfied it was not caused by fires. He was equally convinced that before many years were gone by we would have a system of tapping by which we would have a constant flow of kino. For tapping purposes the young regrowth would be more valuable than the old gnarled trees at present in the forest.

Mr. SHARP said last summer he had collected six sacks of jarrah seed. The seeds had been thrown in the office yard; there had been no fire but thousands of seeds had germinated. He said that jarrah seeded between November and January.

Mr. McVICAR: Not every year.

Mr. SHARP: In a seed year. Before beginning this regeneration work we should put a fire through just before the seed fell. The seed would then have a good bed to fall on.

Mr. STOATE said the question of seed years was an important one. They knew very little about the actual factors which influence regeneration. They were certain that regeneration would naturally follow the silvicultural operations, because there were many examples of this to be seen in jarrah country, but they did not know what period of time might have elapsed in some instances between the operation of cutting and the appearance of the seedlings. Seed was to be found in any year on some trees in the bush, but satisfactory regeneration might take place only after a heavy seeding of all or most trees. If such was proved to be the case, then they must expect, except where cutting operations took place in a seed year, some time to elapse before the seedling regrowth they worked for was established. Burning of those areas on which regrowth was sought for was practised chiefly because it was the most practical way to eliminate root competition for moisture by scrub, when jarrah seedlings were in their very early stages. Incidentally, of course, the fire hazard was reduced by the destruction of debris and scrub.

Mr. McCOY asked did Mr. Stoate advocate putting a fire through.

Mr. STOATE said, failing absolute fire protection such as they had at Mundaring, controlled burning with a light creeping fire was, in his opinion, advisable in certain circumstances. This could be carried out in only those portions of the bush not carrying young growth. It must not be thought the burning of the whole jarrah bush each year was advocated. This was neither necessary nor financially possible. For example, to eliminate the damage caused by the fires raging among fallen crowns, the top disposal operations were carried out. Again, in order to protect those compartments on which seedling growth had been established, the older bush surrounding such areas would be burned with a light creeping fire. With indiscriminate firing it followed that all trees from seedlings upwards were included, and although jarrah in its older stages was not seriously affected by a light fire, seedlings at least were killed back to the ground, and saplings similarly treated or badly malformed, as was exemplified anywhere in the jarrah bush to-day.

Mr. McCOY said when the bush reached the stage when the saplings were a height that an ordinary fire would not reach the leaves, he thought then it was wise to put a fire through about once every twelve months.

Mr. KESSELL asked would that not cost more than complete fire protection.

Mr. McCOY replied he did not think it would cost much. He thought we were only following nature if we put a fire through these groups. The ground was burned in patches. When the saplings had their crowns high enough to be out of danger of fire he thought we should put a fire through.

Mr. KESSELL asked what about the effect of the fire on the root system of the tree?

Mr. McCOY said he did not think fires had a serious effect on the root system.

Mr. KESSELL said food was taken in through the roots, and some of the roots were very shallow. The root hairs must be scorched by those fires. The rate of growth of jarrah was slow, and if it was curtailed forestry might not be worth while as an economic proposition.

Mr. McCOY said there were big trees on this area.

Mr. McVICAR pointed out if you had large trees in conjunction with small, the large trees suppressed and dominated the small.

Mr. McCOY said he thought there were often too many trees to the acre, and that a fire should be put through, otherwise we would get a big fire through and the whole lot would be gone.

Mr. MACKAY, speaking in regard to the regrowth on these experimental areas, referred to an area of one acre, karri country, at Channybeerup. Some 50 years ago that plot was ploughed and a crop of wheat taken off. The regrowth on that was over 97 loads to the acre. A fire passed through that area from year to year. That case spoke for the regrowth of karri. Fires going through the karri country were generally much more severe than in the jarrah country.

Mr. KESSELL said if they knew the road from Manjimup to Nornalup, he thought they would agree the amount of timber left after fires in the karri country, near the Shannon River, was very small indeed.

Mr. MACKAY said that when he was in the Bridgetown district for seven years no fire of any extent went through that country. The sun rarely reached those gullies, and the undergrowth, consequently, was always damp, but in the very dry summer referred to a fire which commenced at Greenbushes went right through to Nornalup, and ruined more timber than if a fire had been run through every year.

Mr. KESSELL said karri country will in many cases only burn after a long interval of years.

Mr. SMITH said there was only one thing he would like to speak about in the karri country: that was some country that had been ringbarked down around Big Hill Brook and at some of the branches of the Warren. The country down there was selected many years ago, and it had been ringbarked and carries a very large percentage of redgum. Whilst classifying those areas he noticed that the karri regrowth absolutely ousted the redgum. For every redgum seedling you would see, say, 100 karri.

Mr. KESSELL said it was the general experience of a great many settlers down there.

Mr. SMITH agreed.

Mr. KESSELL said there was one point in connection with the density of regeneration that was commonly misunderstood by the public, and he would like foresters to be very clear on it. The criticism often in pine planting work was that we plant too closely. Well, with all due respect to Mr. McCoy's observation, nature's way was to start a crop of trees very closely. It was not peculiar to Australia. You must have trees close to prevent the formation of side branches and to secure height growth. The prevention of side branches was not so important with eucalypts as it was with pines. The eucalypts were naturally clean boled. But to draw the trees up in the early stages it was important to have them comparatively close together. The distance of trees in a crop depended very much upon the size of a tree. If it was admitted that a crop of jarrah could only carry 50 trees to the acre when mature, you wanted to start with at least 500 or 600 to the acre. You could not start with trees 30 feet apart if you wanted mature trees 30 feet apart. You must start with them only a few feet apart even if you wished to finish with them 30 feet apart. That was the basis of all silviculture. It was the accepted law of nature which applied all over the world.

There was one other point he would like to make on the limiting of size of permit areas. That was a matter of district administration. When a man applied for a permit area, he usually applied for all the Crown lands within sight that were shown vacant on a plan. When the area was inspected, a report was sent in, and the permit was granted if there was no objection to its going for hewing or sawmilling as the case might be. But the forester should pay particular attention to the output that man was likely to maintain from his mill or by hewing, and limit the area of country recommended to the area he could cut over within a reasonable time. If a man erected a small sawmill plant, he might reckon on working for 10 or 20 years, but there was no reason to give him country to keep going for 50 years. In connection with hewing he might wish to cut for two or three years. There was every reason why a hewing permit holder should compete in the open market every year, and, if a man was going to take off an area, say, 50 loads a month, he wanted an area carrying 600 loads of timber to last him twelve months. He did not approve of giving a man 1,500 or 2,000 loads when it was known that he only wanted 600 loads during the term of his permit, otherwise he would naturally take the best of the timber rather than clean up any particular section. The market value fluctuated from year to year, and, if his permit only carried sufficient work for one year, the upset might be lower next year if the value of timber had decreased, or it might go up. It depended on the price to what extent he could work out the bush. If you reckon the price he is getting for his sleepers—he should get two loads to the average acre and he wants a total of 600—well then 300 acres should more or less satisfy him. If prices were better, you might reckon he could get 2½ loads to the acre. Less country might then do him.

Mr. McCOY said it took a pretty good bushman to estimate to half a load.

Mr. KESSELL said he was trying to emphasise the principle, not any particular case, and the figures given were merely illustrations. Absurdly large areas for hewing had been given in different places where a man would have been satisfied with a much smaller area and prepared to come and bid for another adjoining area next year. We had gone further and, on certain areas, owing to the men running through the bush when they had a limited order, we had had to cut them down and say they should cut a certain coupe and work that out before going on to another coupe. It was the most satisfactory method, but still the supervision involved was much too great to apply it generally over the whole country.

Mr. McVICAR said it really meant that, say we were considering 1,000 acres, and 300 was enough to get his quantity off, the balance of that 1,000 acres was as good in a year's time, when it would be put up again for sale, as it was at the beginning of this year, whereas the other 300 acres would be worked out.

Mr. MACKAY referred to a hewing bush on Sawmilling Permit 27/11. There were originally three 1,000 acre blocks. Hewers were allowed on No. 1 and they remained there until that was passed by the Ranger as thoroughly cut out before being allowed on to No. 2 block. Those blocks were as well cut out as any in the State, and he thought hewing might be controlled in that manner.

Mr. KESSELL referred to the practice that had applied in the past of allowing the sawmiller to follow up his own operations with hewing. It was a bad practice, and the sooner we could do away with it the better. The sawmiller took up a sawmilling permit, and he had no right to take the hewing timber. If he cleaned up the bush with his sawmill, that bush should revert to the department, and, if let for hewing, it should be put up again and bid for as a hewing permit. He knew there were cases where firms had log lines cut in these areas and were the only people who could work in the bush, but these were exceptions. They knew, in practice, that, if the sawmilling firms considered that they would get the bush after the fallers had been through, there was a great deal to be said from their point of view for leaving a few hewing trees about.

Mr. SHARP said the sawmiller should work over definite areas. In the past they had worked over the permits, taken out the best of the trees, a certain amount of regrowth had come up, and they went in and cut all that down again. Once blocks were cut over and finished, they should be deleted from the permit area altogether.

Mr. TURNER asked the Chairman did he think it wise that the hewers should follow the sawmillers?

Mr. KESSELL replied not unless the bush was going to be protected from fire. There was not a great deal to be said for working your bush out entirely if regrowth was not to follow. If regrowth was to follow, then it was advisable to provide for the removal of all mature trees, so that the bush could be left for a long period before it would be worked

again. But if it meant cleaning the bush right out and making no provision for regrowth, he did not think there was any argument for hewers following the fallers, except to help the dividends of the company.

Mr. TURNER said in his district there were quite a number of trees left that the big mills would not take. Spot mills were coming into operation, and he thought that spot mills and fruit case mills on these areas would be more benefit, from the forester's point of view, than the hewers.

Mr. MACKAY said the spot mills would not handle the big logs.

Mr. TURNER said the big mills would not take a log under 16 feet as a rule. The spot mills did handle logs of big girth.

Mr. KESSELL asked were they carting the logs in on large whims or splitting in the bush?

Mr. TURNER replied both. Then there was a lot of undersized timber. If the spot mill came in after the big mill was finished, the Department should reduce the royalty.

Mr. KESSELL said their cutting might form part of the silvicultural operations.

Mr. MACKAY said the question of the fallers leaving logs for the hewers could be dealt with in the way of cutting the bush out under the block system. Confine the sawmiller to a certain area and only allow him to go on to the next area when he had cut No. 1 area out to the satisfaction of the forester.

Mr. KESSELL said that under certain forms of tenure—leases and concessions—there were difficulties, and it raised distinctions between sawmillers. One firm was put under obligation to restrict its operations in a certain way, and another firm was unrestricted. Consequently, there were questions of policy involved in general application of practices of that sort, although there was no question about the results that would be obtained.

Mr. DONOVAN said weather conditions might stop a sawmiller from cutting one block out before shifting to another. In winter time he might not be able to haul.

Mr. MACKAY said that might happen. But you could allow him to go on to another block—a higher block if the first was wet—on the understanding that he came back and finished No. 1 as soon as the weather was favourable.

Mr. RULE said there was one point he would like to bring up, and that was Mr. Sharp had mentioned that some considerable difficulty was found in getting forest workmen to distinguish the trees in the groups. That was a point that was rather interesting. You could hardly expect a forest workman to distinguish the trees in groups without any education in matters of silviculture. In this connection, he thought most people had found that forest workmen in the department were really very keen on knowing the work they were engaged in, and several times we had been asked very interesting questions about exact silvicultural operations that we were carrying out. With regard to ringbarking—he would here quote a little incident. During the war, the War Office decided to cut out the term "fatigue party" and substitute "working party," on the grounds that the term "fatigue" gave the soldiers the tired feeling, and he would suggest that the term "ringbarking" be cut out of the silvicultural dictionary, as it seemed to create in workmen a lack of interest.

Mr. KESSELL asked did Mr. Rule mean that the actual operation of cutting a scarf round the tree should not be called ringbarking, or did he refer to the general operation of ringbarking?

Mr. RULE replied that the forest workman tended to regard the whole operation as ringbarking. Silvicultural cleaning or something like that would be a better term to use.

Mr. KESSELL said in fixing terms regeneration operations were divided into two parts, one the removal of the mature crop by the sawmiller or forest worker, and the second part the "regeneration cleaning" undertaken by the Department. A good deal of thought was given to the choice of these terms, and foresters should endeavour to introduce the terms and have them accepted in forest practice, as suggested by Mr. Rule.

FIRST DAY—Tuesday, 17th July, 1923.

Afternoon Session.

(Paper by Forester L. N. Weston.)

"TOP DISPOSAL OPERATIONS."

Fire protection will, of course, remain one of the basic principles of forest conservation in Western Australia. To be effective, however, fire protection must be intensive.

It is hoped eventually to have a dedicated State Forest of some 3,000,000 acres, and during the interval which must necessarily elapse before such a large area can be placed under sylvicultural treatment, much of our forest country will be at the mercy of those persons who, from various causes, find delight in seeing the fire fiend at play, callous as to the toll it is taking of the forest. Apart from acts of incendiarism, accidental fires arising in those forest areas not at present closely protected present a problem too great to be dealt with by our limited staff, and it is a full realisation of this fact which is responsible for the apathetic fatalism common to those living in the timber country. These people know that unless *effective* measures for fire protection are instituted, fires are sure to run riot sooner or later, and a fire going through after a five years' interval will be more severe than after a three years' interval.

Until our organisation is perfected, therefore, it will be a decided gain if we can minimise the worst effects of these uncontrolled fires, by burning parts of the country at such times and under such conditions as will cause the least possible ill effect.

The most severe fires occur after the prime mature timber has been felled for milling, and the crowns and bark remain to lumber the ground. An uncontrolled

1923.

WESTERN AUSTRALIA.

REPORT of PROCEEDINGS

OF

CONFERENCE of SENIOR OFFICERS

OF

FORESTS DEPARTMENT.

PERTH, JULY, 1923.

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