PLANTING ON THE NATIONAL FORESTS

Paper by J.F. Kummel, Forest Assistant
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In speaking to you today upon the subject of Forest Planting I am aware that I am discussing a phase of Forest work of comparative newness in this District. Some among you who come from east of the mountains where the conditions for tree growth are not so exceptionally favorable as they are upon the west slope may look a little askant at the practicability of artificial reforestation, while others who come from this side of the Cascade Range may declare "Climatic conditions are highly suited to the growth of forests and their natural regeneration, therefore why should we plant? These questions I shall attempt to answer this evening and to point out the need for artificial reforestation, the policy in regard to it, and our plans for carrying it on. As I have just said planting work in this District is of recent origin. In the early days of the Service, before the transfer of the Forests from the Interior Department to the Department of Agriculture, the work was mostly educational and confined to the Eastern and Middle States. Information in regard to the most suitable trees to plant for windbreaks, for fence posts, for farm repair purposes and for fuel was furnished all who asked for it by means of letters, circulars and planting plans. Gradually with the enlarging activities of the Service the scope of the work was broadened and the reforestation of treeless lands in the prairie states, and of denuded watersheds in Colorado, in the Southwest and in California was undertaken. It was not until shortly before the District organization went into effect, however, that a start was made in this District, and yet the conditions here for successful results are of the best and the need is great. Every Forest has its burned areas, parts of which are not restocking, or restocking but slowly. Large areas bare of forest growth but capable of producing timber, are found on many Forests. All of these, both denuded areas and those naturally treeless, must be covered with a forest growth before we can truthfully say that the Forests are in a proper state of productiveness. Figures, however, speak plainer than words and it will help in arriving at a correct understanding of the immensity of the area in need of reforestation if a few statistics can be given. Unfortunately, the data at hand of the total area denuded and treeless, but capable of growing forests, is very meagre and pertains almost wholly to the Forests on the west side. The reports of the reconnaissance study, however, carried on last summer on the west slope and the preliminary planting reports prepared on some of the Forests contain a few statistics. From these I have arrived at a rough approximation of 1,285,000 acres denuded and treeless on a total of 9 out of 11 west slope Forests – an acreage equaling practically 10 per cent of the total area of the Forests. Undoubtedly large areas unfitted to tree growth such as talus slopes, bare rock ridges, mountain marshes, etc., are included in this estimate. It includes also patented land and land which though classified as not-restocking may upon closer investigation prove to be

reforesting naturally. Let us then reduce this estimate 50 per cent thereby cutting this figure in half. There still remains 600,000 acres, and area surely sufficiently large to keep us busy for some time, and this 600,000 acres, remember, includes only 9 out of the 21 Forests in this District exclusive of Alaska. Of the Forests east of the Cascades, it would be only the wildest sort of guess to attempt to name the area capable of reforestation. Safe to say it is no less than that occurring on the west slope. When the proposed reconnaissance study for the eastern Forests is completed, I trust some definite figures will be obtained. There is still a question in the minds of some of you, I know, as regards the advisability and the practicability of planting. "Granted" you say, "that there are over a million acres of denuded areas and areas naturally treeless but capable of growing forests, will not in time these areas all become reforested? The present forests were produced naturally, reproduction is abundant in many localities, why spend money that could be so well spent in other ways, in forest planting when it is only a question of years when the same results will be obtained anyhow?" This brings me to the discussion of the purpose of planting.

First of all, we are to plant, and by this I conclude both planting and seeding, because the fundamental basis of forestry is to seek to bring each acre of land to its highest productiveness. I need not dwell upon this point since it has been thoroughly brought out by previous speakers, but I can not emphasize too strongly the absolute necessity for us to strive toward that ideal perfection of the forest which is reached only when each and every acre is put to its best use, if we wish to acquit ourselves properly of our stewardship. This is fundamental and basic and can not be gainsaid.

There are, however, other reasons why we should plant – reasons which may appeal more strongly to the average layman.

On the beneficial effect of forests on watersheds in preventing soil erosion, and in regulating run-off, there is little question, although some may dispute their effectiveness in preventing excessive floods or periods of extreme low water. The establishment of forests, therefore, on city or irrigation watersheds to regulate the run-off; on slopes where the soil is being carried away, to retain the soil, and through the physical, chemical and physiological activities of the trees, their roots and tops, to manufacture new soils – these are important reasons why we should plant. In the early days of the Service they were the only consideration, and planting was carried on only where it would be an object lesson of educational value, as in the sand hill region of Nebraska, or where it would improve the watershed.

In this District we have gone a step further, however. We say, "Planting for the protection of any city watersheds is of extreme importance and we will give it preference over planting for any other purpose; planting for irrigation watershed protection is important and we will give it due consideration, and lastly, planting solely for the production of commercial timber is not only possible but profitable and we will therefore plant to grow timber. Does the truth of this statement need demonstration? Surely if forest planting is profitable from a financial standpoint anywhere in this country of ours, it is in the Douglas fir belt of the Pacific Northwest. Here we have the rain, the deep soil

and the long growing season, all combining to produce a forest type whose growth is one of the most rapid of any in the world. It is susceptible of proof, however, and I shall attempt to prove it to you by a few figures. First, without going into the detail of the calculations, let me say that seeding can be done at present cost of seed for from $4.00 to $6.00 per acre, and planting for $8.00 to $10.00 per acre. Now, what yield can we expect from a well stocked stand of Douglas fir? From careful measurements taken last summer by the Section of Silvics, an annual growth of 500 board feet per acre is very conservative for average good Douglas fir stands, — many will run considerably over this. At the end of 100 years there will be a yield of 50,000 board feet per acre. Let us place a stumpage price of $10.00 per thousand on that timber 100 years from now. This may seem excessive to some of you, but when you stop to consider the shortage of timber that is bound to come, and that stumpage in the east, in what was once a heavily timbered country is now as high as this and often higher, I am sure you will grant the reasonableness of this figure. Our 50,000 board feet of timber, then, would be worth $500.00 on the stump. There is the expense of planting, however, and of care and protection which must be charged against this gross future yield. In order, therefore, to make the proper deductions, we must convert this income of $500.00, which occurs only at the end of a hundred years from now, into an annual return. At 3 per cent compound interest, this future yield of $500.00 is equivalent to an annual yield of 83 cents. In other words, by way of illustration, this 83 cents is the yearly allowance a bank would be willing to pay its customer if the customer turned over to is some security from which is could obtained $500.00 at the end of 100 years.

There was, however, the original expense for seeding of $4.00 (let us take the minimum cost first) which was incurred the year the new stand was started, and on which, of course, there is an annual compound interest charge. Making allowances for this and converting the interest and principal into an annual expense, it becomes equivalent to 12 cents. There still remains the annual charge for care and protection. This has been fixed somewhat arbitrarily at 8 cents per acre. Undoubtedly this is high at the present time, but may be somewhat low in the future. Taking into consideration, however, the fact that the returns from thinnings at various times throughout the rotation have not been considered, and that if counted in, would tend to counterbalance the annual cost of protection, 8 cents per acre is none too high. Moreover, it might be argued with considerable force that this charge should be omitted from our calculations entirely for the charge must be made against the land whether it is bearing forests or not, since few denuded areas are so large that they require no protection at the present time.

We have then an annual expense of 12 cents for planting, and 8 cents for protection, a total of 20 cents. The annual gross income was 83 cents, leaving a net annual return of 63 cents per acre. This, mind you, is profit, over and above a 3 per cent interest return on all money invested.

With the maximum cost of planting at $10.00 per acre, the net annual profit would still be 45 cents per acre; and at an average planting cost of $8.00 the profit amounts to just 50 cents. Of course, from an agricultural standpoint, this return appears small, and goes to show that land suitable for agriculture should not be use to grow trees, but for a

forest standpoint it is very gratifying. Right here it is interesting to note that under the same conditions of yield, cost of protection and interest rate adopted in this discussion the cost of planting could be as high as $25.00 and still pay the 3 per cent interest. Few acres exist in the Douglas fir type which can not be forested at a cost under $25.00.

I have thus at some length discussed the financial side of planting work in the Douglas fir type. Perhaps, however, I have not answered the question, "Why spend money when natural reproduction will be secured in time anyhow?" Yes, in time, but in how long a time? In 5 years; 20 years? All will admit that no area capable of growing trees, exterior agencies excepted, will remain denuded forever. Little by little, in the densest brush, on the driest south slope, the reproduction gradually creeps in. The question, therefore, as to whether it will be financially profitable to restock artificially or wait until nature resolves itself into one of time. Every year an acre is lying idle there is a loss of revenue represented by the annual increment. If the acre were reforested artificially by seeding at $4.00 the annual revenue derived from it would be 63 cents. Therefore, the growth of the young stand started by seeding will pay for the cost of seeding in 6-1/3 years, and if natural reproduction will take longer than 6-1/3 years to come in, it is more profitable to seed. These calculations could be carried on indefinitely, and the period of natural regeneration corresponding to different costs of formation arrived at, but it would only tire you and be of no value at this moment. Enough has been shown, I believe, to indicate that seeding and planting are financially profitable, and that in cases where natural reproduction will not take place quickly, they give the larger return.

I have been discussing so far the advisability of reforesting as soon as possible the denuded and treeless areas of the Forests in order to bring them into a state of productiveness. There is another phase of planting work, however, that I desire now to take up. This is the question of the part planting will play in the future management of the forests as a method of regeneration after cutting. This has been touched upon in previous discussions, but I believe it well to reconsider it here. I shall omit entirely from consideration all reference to the east slope, since I believe natural regeneration in that region entirely feasible and far more economical than artificial reproduction. My remarks, therefore, are confined strictly to the west slope Forests, and I might perhaps go further and exclude the Forests in southern Oregon, such as the eastern part of the Siskiyou, the Crater and parts of the Umpqua. There remains then, the belt along the coast and up the west slope where Douglas fir and associated species attain their maximum development.

Because of its intolerance, Douglas fir does not lend itself to a selected system of management. It occurs in the even-aged stands, and reproduction must be in the open if it is to survive. In this it is unlike its associated species, hemlock, and any attempt at this system of management will result in a stand in which hemlock largely predominates, to the ultimate extermination of the Douglas fir. Of the methods based on natural regeneration, there remains then the seed-tree method, the group method and the strip method. To my mind, all three of these are open to one of two serious objections in addition to others of minor importance. These are (1) the destruction of seed trees by windfall and (2) loss of income through cutting only a portion of the stand. The first has

been touched upon by Mr. Munger and also taken up in the general discussion. The loss in windfall is the most eminent in the seed spot method, and I believe can be considered as certain, at least it has occurred already in one sale. "But," you say, "granted that the trees may fall ultimately, yet the chances are they will stand long enough to reseed the area." Of this even, I have my doubts, so susceptible are the trees which have been growing their entire life within a stand, to wind throw, when the sheltering forest is removed. But suppose it is true, is not the loss of the timber left in the seed trees a real loss? Most assuredly it is, and not a small one, either. At the present stumpage price of Douglas fir, this loss will amount to all the way from $4.00 to $20.00 per acre – sums that will cover the entire cost of artificial regeneration.

Of, course, I realize that often trees may be left for seed bearing, which are forked, conky or otherwise defective and which would not be merchantable anyway. This would decrease the loss from this source. Yes, but will not the loss that **does** occur form merchantable logs that **are** left in the woods, together with the loss arising from two, three, four or even five years' delay, in obtaining a full stand of seedlings, estimated at 50 cents per acre per year, and the loss from the extra care necessary in logging and slash burning to preserve the seed trees – will not these losses equal the cost of artificial regeneration? I believe it will.

In the group and strip method, the probability of loss by windthrow is not so great, yet by no means unlikely. An instance is known where a strip 500 yards wide on the windward side of the main body of timber was thrown when the stand was opened up. To guard against this danger the areas left must be large, and to insure rapid and adequate reseeding, they must be near together – you remember that in a former paper it was stated that 350 feet was the average distance from the seed tree to which natural reseeding could be depended upon. The amount of timber left will be large enough, of course, to justify a second cutting. This incurs an increased logging expense, the duplication of skid roads, logging roads, camps, etc. Former construction will be of little value in the second cuttings in order that the new stand may reach a seed-bearing age; otherwise, the second cutting area would not be reforested. The less timber taken off an acre, the greater will be the fixed charge against what is cut to cover construction costs. When the largest gross yield possible is cut down one-half, one-fifth or even one-tenth because of the fact that a part of the stand is left behind in the woods, the net yield is decreased even by a greater amount. Add this loss from curtailed production, which I assure you is a real loss to the lumbermen and one that is bound to be reflected in stumpage prices, the loss from windthrow, some of which is bound to occur, and the loss from only partial reproduction, and I believe it reasonable to state that the sum of these three losses will offset the cost of artificial regeneration.

There remains still, one further advantage in seeding or planting, that of choice species. Natural reproduction can be obtained only of those species which occur upon or adjacent to the area. Other species, more desirable whether for quality of timber, rate of growth or protection purposes, can not be substituted except by artificial means. An illustration will lend force to this fact. There are on the Snoqualmie Forest large bodies of over-mature timber composed wholly of hemlock, cedar and white fir. Originally,

Douglas fir was included in the mixture, but as the years passed, the original stand of Douglas fir succumbed to old age, died and fell down. The long lived cedar persisted; the tolerant hemlock and white fir reproduced itself. The Douglas fir could do neither and dropped out. Here, any system of natural reproduction would result in only hemlock, white fir and cedar reproduction. The Douglas fir can be restored only by clear cutting, broadcast burning, and some method of seed or planting. That is the system already adopted in one sale, on this Forest and will be employed in the future on others.

I have come now to the end of the first part of my paper. Before proceeding further it may be well to summarize what I have already said.

1. Planting work in this District is necessary for the purpose; first, of restocking burned areas, of which there are a total of over a million acres. Second, as part of the silvicultural system of clear cutting followed by artificial regeneration.
2. Planting in the Douglas fir type on good average sites is financially profitable and there is a direct loss of a yearly return of from 63 cents to 45 cents per acre for each year that an acre lies idle, depending upon the cost of artificial reproduction and the extent to which the area is partially stocked.
3. We must plant it because it is our aim to bring every acre into a state of highest productiveness, because of the protection afforded watersheds and because it is financially profitable and we are in the business of raising timber.

And now a few remarks as to policy and our plans for conducting work: We are going to reforest city watersheds in need of reforesting – on the Bull Run watershed supplying the city of Portland, we make a start this spring. We want to go ahead with reforesting irrigation watersheds east of the mountains just as fast as conditions will warrant, and we are going to start forests by seeding on the west side of the mountains for the purpose primarily of raising timber.

It is our policy to favor direct seeding rather than the planting of nursery stock for two reasons.

First – Because it is cheaper; second, because it gives more immediate results with less initial outlay of money. It is cheaper, because on favorable sites it can be done for $4.00 per acre while planting would cost at least $6.00 and might easily be has high as $8.00 or $10.00 per acre. It gives more immediate results with less initial outlay of money because no expensive nursery equipment or expenditures are required.

There are, however, areas on which direct seeding will not be successful and the planting of nursery stock only can be depended upon to produce a stand. Before, however, extensive planting of trees is undertaken direct seeding will be tested on all types where it gives any promise of success.

As I said early in the beginning of my paper, it is only a year and a half since planting work was first started in this District. We have, therefore, no experience of others to turn to for guidance in conducting the work. Moreover, in the other Districts, direct seeding has been but recently tried and the results not always conclusive. We are obliged to feel our way slowly, testing various methods, drawing on the experience of European foresters as far as possible, and relying upon our own judgment to indicate what may possibly be successful and what is entirely impractical. To place the work upon a systematic basis, Forest Assistants attached to Forests, were requested last year to select areas representative of the various types and conditions on their Forests on which to initiate a series of experiments, carefully planned to solve the problems of artificial reproduction existing upon them. Some of these experiments were started last fall, others will be commenced this spring. They embrace tests of many different kinds such as simple broadcasting with no preparation of the ground, burning and broadcasting, broadcasting and harrowing, seep spot sowing with a mattock, hoe and corn planter; small seed spots 12"-18" in diameter, and large seed spots in dense brush where the brush is cleaned out in areas 10-15' across and large quantities of seed are sown. On other Forests where no Forest Assistants were stationed, but where there existed a need for experimental work, Supervisors were urged to start one or more experiments on a type which appealed to them as in greatest need of attention. In this way a beginning has been made toward the determination of correct technical methods to employ in operations on a large scale. Of course, it is too early yet to have obtained conclusive results, or even to forecast what those results will be. The manner in which the experiments have been conducted has been satisfactory on the whole, but there are some ways in which they can be improved. Many of the experiments have been upon too small a scale to give conclusive results. The first tests were made on unit areas of 1 acre. Where the method employed is one of which there is grave doubt of its ultimate success, the area of this size is sufficient – areas of larger size would entail useless loss of seed and labor. On the other hand, when the experiment is one which it is believed will prove successful, such as seed spot sowing, or broadcasting followed by grazing of sheep over the area, five, ten, twenty-five or even fifty acres is none too large an area on which to conduct the test. The larger the area, the greater will be the variations in topography, soil ground cover and other factors of site that are included within the test and the results obtained can be applied to extensive operations, with more confidence than if they had been derived from one or one-half acre tests. Furthermore, an extensive experiment affords more accurate data on costs, and gives a better basis for calculating the costs of large scale operations. Make the test large enough so we can have confidence in the results.

Another point I wish to emphasize is the great importance of performing the work at just the right time. Because of the nature of the planting work it can be done only in the spring or the fall, and on many Forests even then for only short periods. Work in the spring should be started immediately after the snow disappears, and should be continued rarely longer than a month thereafter because of the approach of the dry season. In the fall the possibility of early snow demands that the work be completed early in order to run no chance of being interrupted or forced to quit before it is completed. Last fall there were two or three instances where the experiments were

postponed until the winter storms commenced, and it was too late to complete them. Of course, it is not possible to foretell an early winter or to say in advance just when the first storm will come, but the possibility of such and occurrence should be recognized and plans made accordingly.

In all experimental work, records are of prime importance. Without proper data, results can not be interpreted and the experiments lose much of their value. A certain experiment may be very successful one year, but an absolute failure when repeated again the year following. Without sufficient data we would be at a loss to give a satisfactory explanation, but if the record showed that the dry season commenced particularly early, and shortly after the seed was sown, the reason would be evident. Not only, then, is it important to record the climatic conditions at the time the experiment was performed, the condition of the soil, and the methods used, but also to make notes from time to time during the season following of any abnormal occurrences which might influence the results, either favorable or unfavorable. The area should be visited as often as other work will allow, and notes made on the progress of the experiment.

One year's results can not always be depended upon, and it is wise to repeat the tests a second and even a third time before the results are accepted as conclusive. As the work progresses, new experiments will suggest themselves and should be initiated as opportunity offers. It would not be possible, even if desirable, for the District office personally to initiate and supervise all seeding and planting experiments, since the nature of the work is such as demands careful and thorough study by one who is familiar with conditions on each Forest. Forest Assistants attached to Forests should consider this work as an important part of their duties and should give it the consideration it deserves.

We are anxious to go ahead on a large scale in our planting work, and just as soon as our experiments indicate the best methods to employ, we will be in a position to push the work vigorously. Already we are confident of success in the Douglas fir type with the seed spot method and we are going ahead this spring on a large scale on several Western Forests. We want to do the same on the east side, when the correct methods are determined.

SEED COLLECTING

A supply of seed, of course, is necessary before we can undertake any seeding experiments or nursery work, and I would have discussed this subject earlier in my paper had I wished to treat the subjects in a natural order. I have left it to the last, however, in order that it may be fresh in your minds when the time for discussion arrives. To some of you, perhaps, the matter of seed collecting appears to be outside the regular work of Forest offices, and one to be avoided if possible. Unfortunately, with the exception of Douglas fir, tree seeds can not be purchased in the market in large quantities and at a low price, and it is absolutely necessary to obtain the seed on the Forest. Of the various species, Douglas fir, yellow, sugar and white pine, Noble fir, cedar, western larch and Sitka spruce, will be in greatest demand. Collecting can be

done only during a short period of three or four weeks' duration, and it is necessary to make plans in advance in order that the work can be pushed vigorously when the time for collecting arrives. Each Forest should attempt to collect enough seed for its own use, and where the crop is particularly abundant, or conditions exceptionally favorable, a surplus for use on other Forests. On the west slope where Douglas fir represents the principal species to be collected, collecting from cutting operations has not proved practicable because of the fact that when the tree falls many of the cones are knocked off the branches and lost in the underbrush. Collecting from standing trees by climbing and picking the cones off the branches has been tried, and, impracticable as it may seem, it has proved to be the only successful method. Second growth trees growing in the open or in a thin stand, are the best suited for this purpose, since they usually bear a more abundant crop of cones than the older timber, and are easier to climb. The collector equips himself with a lineman's belt, a pair of climbers, and a sack fitted with a hook. He climbs to the top of the tree, attaches himself securely by means of his lineman's belt, hangs the sack on a limb, and proceeds to strip the cones from the branches and drops them into the sack.

In regions where squirrels are numerous, large quantities of cones can be obtained cheaply from the supplies which they cut down and bury among the litter under the trees.

The cones of the pines are large and the underbrush is not usually dense, so that collecting can be done readily from lumbering operations. If necessary, however, the cones can be obtained by climbing the trees. Noble fir can be obtained by either of the methods mentioned, though climbing is more difficult than in the case of pines or Douglas fir, as the cones occur only at the extreme top.

The cones open when dried. Where the weather will permit, this can be done most economically out of doors by spreading the cones out on sheets where they will be exposed to the sun and wind. Where the weather will not permit air drying, as on the west slope, arrangements must be made to dry by artificial heat. Where it is expected large quantities of cones can be collected yearly, it will pay to build a seed dry-house, fully equipped for the work. Such a house should be located in a central place to which cones can be shipped cheaply. This is not always possible, however, and a temporary dry-house must be fixed up. An old cabin equipped with a stove, and shelves on which to spread the cones will answer the purpose.

When dried, the seed is loosened by pounding and churning the cones, and separated out by screening. The final process of cleaning can best be done in town where a fanning mill is available.

It is not necessary that Forest officers do all the work of collecting. Your authorization will be increased to hire temporary labor if you wish to do so. Interest the settlers in and near your Forest to collect cones, paying them so much a sack for delivery at convenient places. I am sure that if they knew the Forest Service would purchase all the cones they collected, they would look forward to cone picking time as an opportunity

to earn some extra money. Do as one Supervisor did, distribute circulars among the settlers advertising that you will buy the cones, and corral the school children after school and set them to work. Seed must be collected if we are to go into extensive planting and seed operations, and it will be up to you in a large measure to collect it.

A word in conclusion. Push the experimental work where experiments are needed, so that we can go ahead on a large scale as soon as possible.

Where extensive work is justified now, put it up to the District office to supply you with money to carry it on.

Keep watch on the condition of the seed crop, make your plans for collecting, and go out and get the seed.