

HAZARD REDUCTION IN THE TILLAMOOK BURN AREA
BY SOCIAL AND ECONOMIC MEANS

by

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INDEX

	Page
Introduction	1
PART I	
Present Conditions in Tillamook Area	4
PART II	
Conditions and Problems Facing Counties Due to Burn	12
General Summary for Part II	15
PART III	
The Proposed Plan	16
General Study of Part III	22
Recommendations On Future Use and Possibilities for Operation of the Proposed Plan	24
References	27
Tables Showing Ownership and Acreage Burned in Fire	28
Table I	28
Table II	29

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INTRODUCTION

Purpose: The Tillamook fire burned one of America's largest remaining fine stands of privately owned timber. This affected in a great measure the invested capital, employment of men, and finances of the counties, states, and the future use and ownership of land concerned.

After every large destructive fire, be it in Oregon or some other timbered area; the problem arises as to just what should be done with the area and how ^{a solution} it should be attempted. Such problems have naturally arisen in the Tillamook area and attempts have been made to solve them, but as yet little progress has been made in this direction, due mainly to fire hazard, deterioration of timber, and the difficulty of financing an operation of such magnitude. It should be noted that this paper is not one on salvage operations in the burn, but a method of hazard reduction, in which salvage operations are a small part. Salvage operations, however, have been successful to a degree and the future of salvage operations prior to 1939 looked promising but due to the re-burn of most of the area in 1939, and due to increased activity of beetles, salvage operations have progressed very slowly.

It is therefore, my idea and main purpose in mind in writing this paper to advance some sort of an idea which

might in some way help to decrease the fire hazard facing the counties in the Tillamook area due to cut-over and deteriorated timber. If regeneration on the area is to be successful and the lands made permanently productive once again the obstacle in the path of successful regeneration, fire hazard, must be removed.

Importance of Problem: It is known that about one-third of the people of Oregon are dependent upon lumbering and allied industries for their livelihood; that approximately one-half of the tax-base for one of the counties in the Tillamook area was based upon timber lands destroyed by the fire; that these same counties have been depending on taxes levied on these lands to finance the public services usually provided. With these points in mind it is apparent that something must be done in the near future, if said counties are to remain in the picture as financially solvent units of the state system, or to become bankrupt burdens upon an already overburdened state and national government.

Related Previous Subjects: The general subject of the Tillamook burn has been written about several times, usually from the standpoint of an appraisal of the damage. There has been little or nothing written about the solution to the problem created by the fire damage, especially from the standpoint of using unemployed labor for fire hazard reduction in the area. One such plan, used in Sault St. Marie, in northern Michigan, at a State Experimental Forest, was to offer free wood to the unemployed and poor people of the

towns if they would but cut and haul it away for themselves; the wood to come from improvement cuttings and thinnings to be made on behalf of the Forest. This idea seemed to work out well. It was based upon the idea that there would be firewood available for the unemployed, and if they wanted to keep warm they could get it there. The general theory behind this arrangement will be carried over to this paper.

Method of Procedure: The general method used in this paper was to make a cursory examination of such written materials as were available on the subject from such sources as: Timberman, West Coast Lumberman, Four L Lumber News, Oregon State Planning Board, and from the Pacific Northwest Forest Experiment Station.

The first part of the paper is a general discussion of the Tillamook burn, its nature, present fire hazard conditions, and consequences of depletion brought about by the fire. The second part is to be a plan proposed for the removal of the fire hazard in these areas by social and economic means. The plan, in the main is mostly theoretical, an idea from which, it is hoped, something could be worked out which would offer some help in the removal of fire hazard in the form of timber and snags in the burn area.

PART I

PRESENT CONDITIONS IN TILLAMOOK AREA

The Tillamook Fire: The fire started at 12:30 p.m. on August 13, 1933, in Section 17, Township 2 North, Range 5 West, Willamette Meridian. The fire had started on privately owned timber lands and swept through some of the finest remaining virgin timber in the Pacific Northwest. In eleven days the fire burned over 244,706 acres of land and destroyed or consumed more than ten or twelve billion board feet of timber valued in excess of two hundred million dollars. The fire covered the main watersheds of the Trask, Wilson, and Kilchis Rivers, and portions of the watersheds of the Miami, Nehalem, Tualatin, and Yamhill rivers.

The elevations of the burned area vary from fifty feet above sea level at the western edge to more than two thousand feet at the summit of the Coast Range. The entire area is well drained and is cut up by a great many steep ridges that run in a general east-west direction.(3)

In general, most of the area was occupied by the Douglas-fir forest type. In the main, the stand was dominated by old growth fir (*Pseudotsuga taxifolia*) and contained a mixture of western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and a scattering of lowland white fir (*Abies grandis*). On the western edge of the fire, the coast area, Sitka Spruce (*Picea sitchensis*) and western hemlock predominated. Table 1 (8) will show the

type and percentage of acreage burned in each of the individual counties in the burned area.

Present Fire Hazard Condition on Area: It is generally recognized by all concerned that the fire hazard on the Tillamook burn has been and still is most severe. Since the time of the fire the area has been closed to entry during the fire season as a precautionary measure, and steps were taken in the form of protective slash burning laws, etc., to reduce the hazard. Many of the fire-killed trees have shed large quantities of bark and limbs. The tops of many dead trees have broken out and fallen to the ground, and many others have been windthrown. Thus, the fire hazard is ever on the increase with the increase of inflammable materials added to the surface of the area. These conditions intensify an already severe fire-hazard condition which will remain acute until the new stand becomes well enough established to protect upcoming reproduction, (3) or until logging of salvage nature comes into the picture more definitely than at present.

✓ There has been considerable new road and trail construction in the area which has greatly improved transportation in and out of area in case of fire. Salvage logging operations are helping to form an effective firebreak through many portions of the burn. With the continuation of such construction and salvage operations the reduction of the fire hazard on the area will be greatly advanced.

Although salvage operations have lessened the fire hazard to a certain degree, the present method of logging followed by broadcast burning is destroying practically all of the established reproduction on the areas, thus creating an inadequate seed supply for future natural regeneration of the areas.

Insect and Disease: It is a well known fact that the beetles in the pine country have logged as much if not more than the loggers themselves, in the past few years. The same condition is the cause for great concern among the salvage operators in the burn area. Beetles are abundant and cause the greatest damage. They bore into the sapwood and eventually enter the heartwood, making numerous large holes or mines in the timber. As a result, both the quantity and quality of the timber salvaged is lessened to a great degree.

It is doubtful if losses due to fungi is of greater importance after the fire than before; but at any rate, losses from this cause are of sufficient importance to be considered as increasingly dangerous to salvage operations.

Natural Reproduction and Regeneration on the Area:

From a study made in 1936 and 1938, and an reexamination in 1939, (3) and from personal observations of the area on two occasions it is apparent that there are few large areas entirely devoid of seed trees. Green trees are numerous as individual trees, in groups and on unburned islands of the fire. These seed trees were noted in places where the fire had moved slowly but are also scattered sparingly throughout

the burn. Single seed trees are dying due to increased beetle attack. It has been noted that many disease-weakened trees were killed completely by the reburn of this area in 1939, the effect of which has been to greatly reduce percentage survival of trees injured by disease and previous fires. Many of the trees are succumbing to either fire injury, change in exposure, or beetle attack, or a combination of all three. Large annual losses of seed trees can be expected. The green trees remaining on the burn and some bordering trees now provide the only source of seed for additional reproduction on the burn. As these gradually die, the seed supply will gradually diminish. (3)

The conditions of restocking and regeneration on the area are well summed up in the following quotation from the 1938 report of Leo Isaac: "A slight decrease in stocking was apparent on all areas reexamined. Few new seedlings have become established since 1935, probably owing to a diminishing seed supply and an increase in amount of competing vegetation. The addition of new reproduction has been more than offset by mortality of older seedlings. However, the older seedlings are now well established.....Planting or artificial seeding would probably be necessary to put many of the nonstocked areas back into forest production.....The great number of snags and the widespread accumulation of surface debris combine to form a fire hazard that is by far the greatest obstacle to the regeneration of this highly productive forest area."

Ownership Status of Area: Most of the land burned was in private ownership at the time and since has reverted, or is reverting to the counties for delinquent taxes. The better blocks of timber were owned by some of the larger timber holding companies of the region who were depending upon such timber to supply their logging operations with the best timber for many years to come. Tables I (9) and II (5) show acreage by percentage of the different types of timber destroyed in the different counties in the burn, and class of ownership and forest cover.

Previous to the fire, the counties in the area had as much as forty per cent of their taxes based upon the value of the timbered area consumed or destroyed in the fire. As a result of the fire the private owners were unable to continue operation or to pay taxes on burned and cut-over unproductive land, thereby letting their lands revert to the county; consequently the counties are fast becoming the major owners of unproductive timber land in the Pacific Northwest.

Present Status of Salvage Operations in the Area:

Experienced operators state that breakage loss in fire-killed timber is double that of green timber. Hazards are greater in dead stands than in green as the dead tops break off and menace the fallers. Logging costs seem to increase directly with the amount of deterioration in the timber (6).

It seems that Douglas-fir and western red cedar deteriorate less rapidly; and in the opinion of some operators, these are the only species salvageable after two or three years. It seems that the greatest amount of salvage operation can be carried on in areas where Douglas-fir is the dominant type. In some of the area being salvaged at the present time the type is fir-hemlock, with the hemlock forming sixty per cent of the stand in some cases.

Very little salvage work has been done in the Spruce-hemlock type; due to the large amount of carbon in the logs after they have been burned, thus they are practically worthless for the phase of wood utilization for which they are used, namely, wood pulp for paper making.

In areas where the percentage of fir is relatively high, logging costs have increased largely due to the loss in scale due to insect damage in this species.

There are several large and some small mill companies salvaging the burn. Some of the companies are operating directly in the burn and some on the edges. The Stimson Lumber Company at Forest Grove, Oregon, is logging approximately thirty-six million board feet per year, getting about twenty-five thousand board feet per acre (3). The area upon which they are operating contains about 1,300 acres. At the present time they are taking out about one-third of the original cruise of the area. The sap is completely gone on the fire-killed timber which results in a loss of about twenty-five per cent on the scale for this reason, and in

addition worms are in the heart of the wood from two to six inches.

The Stimson Lumber Company is carrying on a very interesting experiment endeavoring to realize higher utilization from their wormy and fire-killed timber. The plan at present is in the experimental stage but consists of plugging the worm holes in the lumber with a plastic material. At the present time this type of lumber is of no commercial value but the company has high hopes of obtaining an outlet for their wormy fire-killed timber by using this process.

Prior to the second burn of the area in 1939, over one billion feet of fire-killed timber had been logged off the area of the Tillamook burn by various operators, but it is said (8) that it is doubtful if more than 500,000,000 feet more is salvageable.

During the time that plans were first made for salvage operations on the burn, such government agencies as NRA and others were in effect. Steps were taken to get the quota increased for fire-killed timber from the Tillamook burn, but the steps were slow and before they could be put into operation NRA was declared unconstitutional. Some plans were made to get government loans or money to finance salvage operations and to log the entire burned area as quickly as possible, storing logs in water and then selling them as the market demanded. These plans, like the others did not materialize and the logging companies had to arrange for their own financing, and then log according to market demands.

Since 1936 and 1937 the lumber market has steadily become better and the demand has increased; but it seems that labor troubles and shutdowns have slowed down or stopped salvage operations entirely; this is important in that all salvage operations there is a limited time only, in which the logs can be salvaged at a fair margin of profit; thus all delays are resulting finally in an increasingly larger and larger annual loss to the salvage operators in the burn.

Future of Salvage Operations in Burn: It seems that most of the operators are of the opinion that only the best logs can be taken out at a profit; they therefore do not take any but the best to be had. Many times one log is taken out of what should have been a three or four log tree. It seems that operators have found this method the most profitable, even though they incur larger construction and moving costs in logging by doing so. This method does seem best when one stops to consider that not all the damaged timber can be removed before such time as deterioration reaches a stage where recovery of any sort is impossible.

PART II

CONDITIONS AND PROBLEMS FACING COUNTIES DUE TO BURN

The great havoc and destruction wrought by the Tillamook fire is perhaps not fully appreciated even yet by the average taxpayer or layman. The fire affected (1) forest products, (2) employment, and (3) county tax bases.

(1) Damage to Forest Products: Within the exterior limits of the fire, 14,448,000,000 board feet of timber was standing before the fire, of which about eighty-two per cent was Douglas-fir, fifteen per cent hemlock, two per cent cedar and one per cent other species; the bulk of which was mature merchantable. About $12\frac{1}{2}$ billion feet was affected in some way or another in the immediate vicinity of the fire. Timber destroyed in the fire would have kept a mill of 250,000 feet daily capacity running full blast 300 days a year for 146 years, supplying enough lumber to build homes for all the people of Portland, Seattle, San Francisco and Los Angeles. This amount of timber is approximately the total amount of timber reported for the production of lumber, lath, shingles and pulpwood of all the mills of the United States in the year 1932 (9).

(2) Loss to Employment: Figuring on the average of two men (one in the logging camp and one in the mill) will produce 1200 board feet per eight-hour day, or 150 board feet per hour; one man would produce 75 board feet per hour. Using these figures as a base, it would take 167 million

man hours to produce $12\frac{1}{2}$ billion feet from stump to sawmill, not considering the man hours in transportation, etc. The above total gives over four million man weeks of 40 hours each; e.g., nearly 14,000 men, and with dependents would make a total of about 76,000 persons working six years to mill the lumber destroyed in the Tillamook fire (9).

The persons now working on the salvaging of the burned area are so few that they can hardly be considered, as they do not in any way change the general picture presented above.

When one considers that fully one-third of the people of the region concerned previously earned their living from the timber or allied industries now destroyed, it can easily be seen that employment has suffered directly and indirectly from the Tillamook fire. These people must be absorbed in industry somewhere; some have gone on relief, others have other work.

(3) Tax Base for Counties Removed by Fire: Tillamook county will be considered as an example for the discussion in mind, although it was hit hardest of all, its condition gives a good picture of just what is happening to the finances of other counties.

Timber values, not including logging equipment and logging railroads constituted about fifty-eight per cent of the tax base (assessed valuation) for the county prior to the fire. It is a well known fact that the forest tax law was not predicated upon the producing capacity of the land but

upon the present value of forest crops that normally would not be harvested for many years in the future. Most of the public services of the counties conducted for the peoples of the counties were built upon this foundation and their successful administration, maintenance, and debt retirement have depended upon its operation. In 1932 about one-third of the privately owned lands within the fire area were delinquent for taxes levied in 1933 and prior years. The accumulated tax bill on private timber in 1933 approached nearly the million mark, a portion of which may be recovered year by year through future salvage operations.

GENERAL SUMMARY FOR PART II

A summary of such facts presented in the previous discussion shows that:

A. The Tillamook fire destroyed over ten billion feet of merchantable timber on 244,706 acres of land in northwestern Oregon.

B. Consequences of fire resulted in:

1. Loss of employment to approximately 76,000 (9) persons.
2. Removal of as much as fifty-eight per cent of tax base of some counties in the area.
3. Successful regeneration in the area can be completed or brought about only when and if fire hazard reduction to the regeneration of the area^{is} reduced.
4. Salvage operations in the area are having to compete with deterioration of the timber at a rate faster than salvage can be carried on.

From the data presented it is apparent that some plan must be presented which will place the area in a state from which successful regeneration can be established; it is seen that such cannot be done without reduction of the terrific amount of hazard prevalent in the area.

PART III
THE PROPOSED PLAN

It seems apparent from previous data that the greatest obstacle in the way of a plan for the regeneration of the areas in the great burn is the reduction of the fire hazard. The fire hazard consists mainly of snags, and beetle-killed or deteriorated timber left by the salvage operations as non-merchantable timber. It is this type of material which is the greatest detriment to successful regeneration on the area, according to an opinion expressed by Leo Issac (3).^(page 7 of this paper) Therefore, if a means of hazard reduction can be introduced which would be economically feasible and at the same time practical, it would seem probable that regeneration could be established on the area and the land returned to productivity. With these factors in mind the following plan is advanced in the hope that it may in some small way serve to make reduction of fire hazard in the area feasible yet practical.

The proposed plan consists mainly of the establishment of camps of unemployed men in the area of the Tillamook burn. Men of the camps will be engaged in making the area productive and in making regeneration possible through fire hazard reduction. It is expected that this program will eventually result in other benefits such as:

1. Hazard reduction in area.
2. Reemployment of working men in area.

3. Production of free cordwood for unemployed.

4. Help to secure the best use for the land.

General Administration and Management of the Camps: It is planned that the administration and management of these camps should be under the supervision of a technically trained forester who has had both experience in planning and administration of ^{forest} lands. This seems necessary when one considers that the work to be done is such that technical forest training and background is called for.

It probably would be best to have a project superintendent (the technically trained forester) in charge of the whole project. Helping him we should probably have an advisory board made up of forestry, state, county, and federal representatives who would assist in determining the general policies for the control and operation of the project. Although this is planned as a relief project certain of the administrators and officials should be paid well enough to offer an attractive position to men qualified for the job.

Under the project superintendent there should be camp foremen who would have direct supervision and management of each individual camp. Each camp foreman should be a technically trained forester also. The more or less small details of camp operation will not be discussed in this paper as it is felt that they are not relevant to the discussion at present.

Establishment of the Camps: The camps are to be established under some sort of government agency as a relief project. The funds for the establishment and operation of the camps are to come from government appropriations.

In the past, WPA appropriations have been made for such projects as roadside improvement, city beautification, construction of public buildings, etc., and CCC labor and money has done improvement work in the restoration of public and private lands damaged by soil erosion, etc. If such work has been done by the government before, why could it not be possible to obtain federal money for the establishment of camps to help to restore some of the vast areas of public and private land destroyed by the Tillamook fire?

It is planned that the camps shall occupy the sites of former logging camps in the area. There are a number of such camps available which would make good locations for hazard reduction work as they are located near the centers of work.

The camps are to be such that they will provide complete living quarters for the men located there. Being that the location of the camps will be in the woods, it is planned that the men will be given week-ends off and transported to the various towns to spend the week-ends with their families.

Camps will be patterned after the CCC camps, as their method of operation and layout has proven quite successful in this type of venture as they are somewhat similar in nature.

The number of camps established will depend largely upon the success of the first camp established; and future policy will depend and ^{will} be based upon its successful operation.

Specific Plan For Hazard Reduction: From a general inventory of an intensive nature, or from a close study of available maps and printed materials the general location of the areas most hazardous to natural regeneration of reproduction shall be noted and studied. These areas are likely to be areas of better site classes because of the density of previous forest cover. These special areas are to be studied with a view to reducing the fire hazard by the removal of the snags and dead ignitable timber on the areas.

Priorities of hazard reduction shall be decided and the plan of hazard reduction should be made following somewhat the same pattern of a good logging plan; showing what areas are to be cut at what time and in what order. Thus all the areas to be cut shall be plotted on the map into different units.

As far as possible work should be planned so that weather will not interfere with the project operation. In the areas within the project there are enough roads already built and new ones are being planned so that it is likely that seasonal changes will not affect the work on the project. Should wet weather cause trouble, the plans can be changed so that work in winter accessible areas will be done in winter and others in dry weather. It should be kept in

mind that all the plans, even the main idea of the plan itself, should, and must be made flexible enough to take care of possible circumstances which may alter conditions of one kind or another.

Operations Plan: The exact and minute details of a plan for woods operation are not necessary here (as this paper is the presentation of an idea, not detailed plan) and will therefore consider just a general plan for actual operation.

It must be kept in mind that this project is to be a relief project and that ~~while~~ machinery which could be used will not be used except where absolutely necessary, and that hand labor will be used wherever and as much as possible.

The woods crew would be much the same as a regular salvage logging operation. There would be various sets of fallers and buckers, in fact most of the men will probably be employed at such work. Logs will probably be bucked to small sizes and then yarded to truck loading areas by manual labor if possible, or where not feasible, machinery will be used. The logs will be hauled either to the woods camps or perhaps more logically to central wood yards to be established in centrally located cities in the area. At the wood yards the logs will be cut into cordwood.

Yard Operation: In these centrally located wood yards the wood will be cut by hand labor into cordwood, then distributed free of charge to the families of relief workers in the area. Should cordwood in excess of the needs of

people on relief in the areas accrue, some plan would be formulated whereby other government agencies would be able to get the benefit of the free wood.

Division of Labor: In the proposed project there will be a demand for various types of workers, skilled and unskilled. The relief workers will be given work in which they are capable, e.g., truck drivers will operate trucks, equipment operators should handle machinery, fallers, sawyers, buckers, and general woods workers will do the work for which they are best fitted. Office workers will keep records of men, time, supplies, amount of work completed, etc. There will be a variety of work which should furnish most persons an opportunity to pursue their vocations, even though they be on relief.

Equipment: All equipment to be used on the project will be furnished by various government agencies, either by loan or gift.

PART III

SUMMARY

We have discussed the great Tillamook fire, where it was, how it started, what it did, and what damage has resulted from the fire. It might be well to summarize briefly the essential points brought out in the previous discussions of the proposed plan:

A- The plan proposed for reduction of fire hazard by social and economic means includes the following points:

1. A plan for camps to be operated as a relief set-up.
2. Woods camps to be operated by unemployed.
3. Camps to be under supervision of technically trained foresters.
4. Snags and dead timbers will be removed by hand labor when possible, as a silvicultural improvement for the area.
5. Wood resulting from such silvicultural operations or improvements to be cut into cordwood and distributed to the unemployed free of charge.

B- The proposed plan will, it is believed, provide some of the following benefits to the counties in the area if put into practice:

1. Eventual return of burned over lands to tax

rolls of counties through regeneration of the land due to reduction of fire hazard.

2. Relieve unemployment in area to a certain extent.
3. Reduce fire hazard to area in and adjacent to the Tillamook area.
4. Enable young reproduction to get a fighting chance at survival.
5. Supply fire-wood free of charge to unemployed.
6. The above item to reduce county, state, and federal expenditures for relief in area.
7. Would perhaps show that a relief project can be one in which the men take pride in doing something really constructive and of future benefit to all concerned.

RECOMMENDATIONS FOR FUTURE USE AND POSSIBILITIES
FOR OPERATION OF THE PROPOSED PLAN

In this paper there has been a problem presented, and a method proposed which would facilitate the solution of such problem. Time will tell whether or not the plan will have success. With an eye to the future there are some few suggestions which might be made concerning the proposed plan and possible uses to which it might be put, either in its present form or modified to meet future demands:

1. The plan^{is that} of using the unemployed in hazard reduction and wood cutting and regeneration as individual county units. Such county units could be set up to be self-supporting in themselves.

2. The unemployed woods camps could in addition to hazard reduction be used as planting and reforestation crews either as county, state or federal projects.

3. It seems apparent with the current legislation before the state congress that the state or federal government will soon have charge of a great acreage of cut-over and burned-over lands in the area of the Tillamook burn and other parts of the country to be placed into sustained yield units. Is it not logical to assume that before these areas can come under successful regenerative management, fire hazards in the form of dead timber and snags must first be removed. Why not use the plan proposed in this paper? Why not use unemployed

labor to help make these areas ready for regeneration?

4. It could easily be suggested that these men in unemployed woods labor camps be used as an additional fire protective and fire fighting force if need be.

5. Another suggestion might be this: It has been shown that the salvage of the fire killed timber in the Tillamook burn is progressing slowly under private operators, and that they are having to compete with the beetles in the salvage of the timber. Why would it not be feasible for an organization, such as proposed in this paper, financed as a relief project to undertake to salvage the timber of value still remaining in the burn: The government with such a plan, could salvage the timber under conditions which would not be profitable for the private operator. Concerning the marketing of such government logged timber, why could it not be used in the construction of such government buildings as barracks for soldiers at the new army posts. Such construction could easily use such lumber as might be salvaged from the burn.

6. It is apparent that there are many different ways of setting up projects of a conservation nature which could be based upon such a plan as proposed in this paper. By using this plan such projects could be effectively, and economically completed with the use of relief labor in organized units. With all the money being spent for relief (dole) why could it not be possible to use

some of the people most affected by "Oregon's greatest tragedy" in projects to restore, regenerate, and rebuild the areas which were once the source of recreation and a livelihood to a large part of the people in the great Pacific Northwest?

References

1. Cronemiller, L. F., "Oregon's Forest Fire Tragedy",
American Forests, vol 39:487-90. Sept. 1933.
2. Furness, R. L., "Bark Beetles Active Following
Tillamook Fire". Timberman, Jan. 1936.
3. Isaac, L. A., "Natural Reproduction on the
Tillamook Burn Four Years After the Fire".
Pacific Northwest Forest Experiment Station,
January 10, 1938. (mimeographed)
4. Jess, Orville, "Salvaging the Tillamook Burn".
Oregon State Thesis, 1937.
5. Leslie, George, "The Tillamook Burn and Problems
Confronting It". Oregon State Thesis, June 1939,
page 17.
6. Loderwick, J. E., "Salvaging Fire-Killed Timber".
West Coast Lumberman, Sept. 1933.
7. McConnel, R. B. "The Utilization of Timber Killed by
Agencies Other Than Man". Oregon State Thesis,
1939, page 19.
8. Northwest Regional Council, Portland, Oregon.
"Forest Depletion in Outline", 1940.
(mimeographed)
9. Wilson, S. W., "The Tillamook Fire," Four L. Lumber
News, Sept. 15, 1933.

TABLE I (9)

CHART SHOWING ACREAGE BY PERCENTAGE

OF

TYPES OF TIMBER BURNED BY COUNTIES

Type	Tillamook County % of Acreage Burned	Washington County % of Acreage Burned	Yamhill County % of Acreage Burned	Total %
Coniferous Timber Over 20" Diameter	64.2	12.0	.3	76.5
Second Growth Under 20" Diameter	14.1	1.9	-	16.0
Deforested Burn (from Previous Fires)	1.0	.3	-	1.3
Recent Cut- over (Logged Since 1929)	.9	-	1.8	2.7
Non-restocked Cut-over (log- ged before 1929)	.2	2.0	-	2.2
Hardwoods	.8	-	-	.8
Farmlands	.5	-	-	.5
Totals	81.7 %	16.2 %	2.1 %	100.0 %

TABLE II (5)

CHART SHOWING AREAS IN ACRES BURNED
IN TILLAMOOK FIRE
BY CLASS OF OWNERSHIP AND FOREST COVER

Owner- ship	Merchant- able Size	Non-mer- chant- able size	Previous Burns	Recent Cut- over	Culti- vated or Pasture
Private	165,838	30,169	1,790	12,932	420
County	4,436	21,429	565	2,940	-
O & C Timbered	475	225	-	-	5
O & C Non- timbered	370	860	-	210	-
Public Domain	365	1,471	-	30	-

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