FACTORS AFFECTING THE RATE OF DECAY
OF DOUGLAS FIR SLASH
ON MCDONALD FOREST

by

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I INTRODUCTION

The Problem

In the winter of 1935 Professor T. J. Starker of the O. S. C. School of Forestry suggested to the Botany Department that a study of slash on McDonald Forest be started and maintained for three or four years. In order to get the most consistency of methods it was decided to have one student carry on the whole work. This necessitated the choice of a freshman to start and carry on the work. Being the only freshman in the forest pathology class, I was chosen.

The primary objective of this study was to find out how fast slash rotted. This general object was further refined to cover various conditions, as slash in the air, on the ground, and half buried. Each of these positions was duplicated in the shade of second fir and also in the center of a cut-over area so as to give a still greater range of conditions.

In addition to studying the rate of decay of slash, data was also collected on the moisture content at various seasons of the year under each of the situations mentioned above.

A third phase of the problem involved the agencies responsible for the decay, i.e., the fungi. While this is perhaps the minor part of the report, as far as significance is concerned, it did take the most time, equipment, and thought.

Importance of Slash

The problem of slash is far reaching. Its effect is felt upon fire hazard, reproduction, grazing, scenic values, soil and water conservation, diseases, insect control, and, depending upon the degree of utilization, upon by-products.

It has been found that a reasonably efficient logging operation leaves about 155 cords/acre of wood debris in its wake. Of this, 62 cords/acre are of large material over 3" in diameter and 3' long. A slash fire can remove from 9-49% of this, ordinarily about 30%, and only 15% of large logs are consumed. Small material left accounts for 40-200 cords/acre, usually 90 cords; and a light slash fire may not remove more than one half of these small limbs and twigs.(3) With so much slash, we are confronted with the question of the best manner of its removal.

Slash disposal has always been a controversial problem, there being many sides to the question. The principal methods of slash disposal that have been advanced are swamping, piling, piling and burning, lopping, broadcast burning, or leaving the slash undisposed.

In recent years there has been a growing sentiment among men in the lumber industry, as well as the silviculturists, against broadcast burning. This is due to the great advances in fire prevention and suppression. The risk has been so much reduced (38) that there are protective organizations willing to accept the hazard of unburned slash, after only five years have elapsed from cutting, as a normal risk.(34) On the other hand, Isaacs maintains that on some cut-over areas in the Douglas fir region of the Pacific Northwest the slash is so heavy that it must be burned for protection as well as for seedling establishment.(26)

The damage of burning to reproduction is debatable. Some argue that burning kills reproduction and also that unburned slash hinders seedling growth. Isaacs advocates broadcast burning in the heavy accumulations and piling and burning in places of great hazard or on places where seedling establishment is uncertain.(26) The table on page 4 for the Lake States discounts this. Each region has its individuality and must be handled differently.

In Eastern Oregon grazing studies, it has been observed that burning kills the shallow-rooted grasses, such as Poa and Festuca; also that Ceanothus and lodgepole pine get so thick after burning that grazing is impossible. Undisposed slash may prevent overgrazing, add humus, and conserve moisture.(33) On the other hand, some contend that unburned slash hinders the utilization of forage, and much is wasted. There have been cases of stock getting caught in larger slash and injuring themselves. The classic argument is that burning makes the grass grow more vigorously. This question has caused much trouble in the Coast regions.

In studies made of the effect of burning upon soil conservation this has been disproved. But examples are still given that are hard to explain. A study made in

DAMAGE TO ADVANCE GROWTH BY SLASH DISPOSAL

Showing the % of damage to advanced growth of jack pine, all age, 6" diameter limit in the Lake States region.

Method of Disposal	Injured	Killed	Undamaged
Swamping	1	3	96
Piling	2	9	89
Piled and Burned	8	18	74
Lopped and Unburned	9	26	65
Undisposed	12	32	56
Broadcast burning	10	78	12

from--Damage to Advance Growth by Slash Disposal. U.S.D.A. Tech. Notes 77. May 1934.

Europe showed that the effect of burning slash was an improvement in the growth of grasses and hardwoods, in addition to a temporary decrease in the pH of both alkaline and acid soils, an increase in nitrification, and poorer establishment of coniferous reproduction. The presence of slash often determined the species of reproduction that would survive. This question remains unsolved in the Northwest. Experiments on burned forest lands in grazing studies on the coast will some day decide the question as to whether the burned areas are more suitable for timber production or grazing.

One effect seemingly entirely in favor of slash is its moisture conserving and soil covering properties. The dense perennial cover developing on unburned areas is more conserving of water than the scantier, largely annual, cover which succeeds slash burning.(16) Slash does slow down soil erosion; and when it breaks down, it adds humus to the soil, increasing its water holding capacity.

The effect of slash upon disease in a stand is negligible in the Douglas fir region. Most diseases that attack slash cannot grow in a normal healthy tree. In the ponderosa pine region many of the slash rots are capable of infecting live trees, but, since it is so dry there, sporophores are seldom formed; and the rots remain in the slash.(33)

In many regions insects in slash are a problem in that they go from the slash to the living tree. However, various bark beetles, such as Dendroctonus and Ips, have been observed as attacking standing trees only in exceptional circumstances.(48) Beetles may attack and kill a live tree after clear cutting operations on adjacent areas or in the case of sporadic cutting within a stand.(33)

The effect of slash upon scenic values is definitely negative. Roadsides, especially, are detracted from by slash.

Slash in by-products of wood may someday be important. In Europe slash is carefully collected for fuel by the peasants. In our own country it is possible to trace the trend in the pulp industry to smaller material and species considered inferior in the past. It is conceivable that some day pulp mills will use slash. Another use for the fibers of slash that will probably be realized before its use in pulp is in fiber board fabrication.

The main issue in slash disposal has been whether to burn or not to burn. The previous remarks and quotations were not meant to support any side on the question; however, it seems that the trend of public opinion is against burning.

My study has been concerned with unburned slash only and in considering usefulness perhaps can apply only to regions where burning is not practical.

II RATE OF DECAY

Factors of Decay

A tree reacts to disease much the same as animals. If a tree is healthy and uninjured, it can usually resist the attacks of most wood rots. Especially susceptible are dead or badly weakened trees. Broken limbs, trunk scars, and broken tops provide entry-courts for the floating spores of the fungi.

The size, species, and position of the slash also influence rate of decay. If the wood is exposed, it is more apt to become infected; however, if enough surface is stripped of protective bark, the wood may dry out sufficiently to keep fungi from growing in its tissues.

Other internal factors are the amount of available water supply, which fluctuates somewhat with the seasons, and air and food supply. Fungi are usually aerobic organisms and as such must have food, water, and air like any living thing. Air and water are obtained through the vessels; the food is the wood itself.

The region of infection will greatly affect the rate of decay in a tree. Sapwood is highly susceptible to decay because of the comparative absence of toxic matter as is found in the heartwood. The heartwood of many trees is recognized as durable against decay because the toxic matter contained discourages the growth of fungi.

External factors, those outside the tree or host, are mainly temperature, moisture, aspect, light, and gravity. Temperature is important in that heat speeds up the rate of decay while cold slows down or stops fungal growth. This bears out the contention that the fungi work on the wood with enzymes. Enzymatic action is chemical in nature and the van't Hoff-Arrhenius Law, which states that for every 10°C rise in temperature the rate of chemical action doubles, applies. Moisture must be present for the tree to conduct in its tissues to be available to the fungi. Light and gravity are important in sporophore production. Light is usually necessary before the mycellium will form the sporophore, and gravity determines the orientation of the pores as can be seen in polypores in which the pores are always arranged parallel to the direction of gravity.

to a certain point only

Review of Related Studies

With this background of factors of decay, perhaps it will be easier to understand why wood decays at a different rate in various localities.

Moisture is one of the most important factors in the infection and disintegration of slash and also in the formation of sporophores which provide for the spread of the rot from one host to another.

Those rots which can work with less water are the ones which usually thrive on dead material. Lack of water also has its effect in retarding sporophore production. Dry, open areas without brush are usually devoid of large sporophores. Long periods of dry weather result in the same condition.(24)

In the ponderosa pine forests of Oregon and Washington Munger states that the slash hazard is materially decreased after only five years, and at the end of fifteen years, slash, four inches in diameter or less, has practically disappeared to neutralize all former hazard above that found in any normal forest. (34) Westveld states that ordinarily at the end of ten to twelve years no more slash remains than the normal accumulation of debris in a virgin forest.(50)

Munger further observed that lopped slash decays more slowly, apparently, because the severed limbs dry out too rapidly for decay to make much progress. However, in the Adirondacks it is claimed that lopped slash decays in half to two thirds of the time required for unlopped slash, and that the moisture absorbed from the soil greatly helps decay. Lopped spruce tops were observed to disappear in six to twelve years while unlopped tops remained twelve to thirty years. In New England branches of hardwoods began to fall the fourth or fifth year while those of conifers hung on from six to ten years.(45) This same condition occurs in seven years in the ponderosa pine regions of Oregon and Washington.(34)

Stevenson states that lopped slash shows a consistently lower rate of decay than unlopped slash in McDonald Forest of Oregon State College.(48) His observations showed that in five years unlopped slash experienced a three per cent higher rate of decay than lopped slash. The theory is that limbs attached to the bole draw water from the main trunk, hastening decay. He concluded that lopped slash has too high a moisture content for the greater part of the year, due to abundant rain and heavy ground cover, for fungi to grow well. Unlopped slash is up in the air where it will be wet and warm enough for fungus growth to occur most of the winter of a normal year in this mild climate. He contends further that neither lopped nor unlopped slash decay during the dry summers.

Lachmund is quite positive in his statements against burning in the Northwest Douglas fir regions.(28) He says that burning does increase heartwood decay; but, in general, decay is slower. Burning retards decay by drying wood.

The resulting dense canopy of weeds and brush increases wetness after about five years and further inhibits decay.

Original Observations

Measuring rate of decay--in this study of the rate of decay of slash it was decided that bone-dry weight was the best criterion of the extent of decay. Stevenson used specific gravity in his study mainly because he did not have original weights to use in his comparisons. He studied his samples after decay.(48) Since this study has extended over three years and started on fresh slash, it has been possible to record orginal weights and progressive weight losses all during the period.

Obtaining samples--The samples were all cut from living, healthy trees within a period of twelve days. In order to simplify the work nearly uniform pieces of slash, all six inches in length and from $\frac{3}{4}$-$1\frac{1}{2}$ inches in diameter, were used. 150 samples were cut with care so as not to loosen the bark or in other ways mutilate the samples. All samples used were cut from Douglas fir trees growing on the edges of what was long known as Avery's woodlot and is now known as the Corvallis City Park.

Bone-dry Weights--All samples were placed in an electric oven (see Fig. 1) at the same time with a temperature of 100°C. The samples were left in the oven for three days. At the end of the third day when the loss in weight of the samples had ceased, all samples were removed and weighed to the nearest gram on a balance (see Fig. 4).

Each weight was carefully recorded with the number of the particular sample. Besides giving dry-weights this drying was sufficiently severe to kill any organisms that might have been busy in the slash samples. In this way all samples were started at the same time as far as decay was concerned.

Numbering--Each sample was given a number for identification. This number was stamped in the ends of the larger samples with steel dies or written upon a common garden tag wired to the samples where they were too small for the stamped number.

Placement of samples--Two locations were chosen in McDonald Forest and designated as Plot I and Plot II. Both plots are in Township 10 South, Range 5 West, Section 36. The plots were located on a slight south-east slope and within 1000 feet of one another. Plot I was in a vigorous stand of second-growth Douglas fir under an almost closed canopy. Plot II was in the center of a cut-over area. (See Figs. 2 and 3)

Each plot contained three sample arrangements. Some samples were in the air, hanging from a wire, some were flat on the ground; and the last group was half buried in the ground humus. The samples in the air were an attempt to duplicate unlopped slash, but obviously they lacked the influence of a connection to a trunk as would be the case normally. The samples on the surface duplicated lopped slash. The half buried slash duplicated the condition of

Figure 1

Electric oven used in dry weight determinations before and after leaving the slash in the open.

Figure 2

Plot I in a stand of second growth Douglas fir in the Spring of 1937.

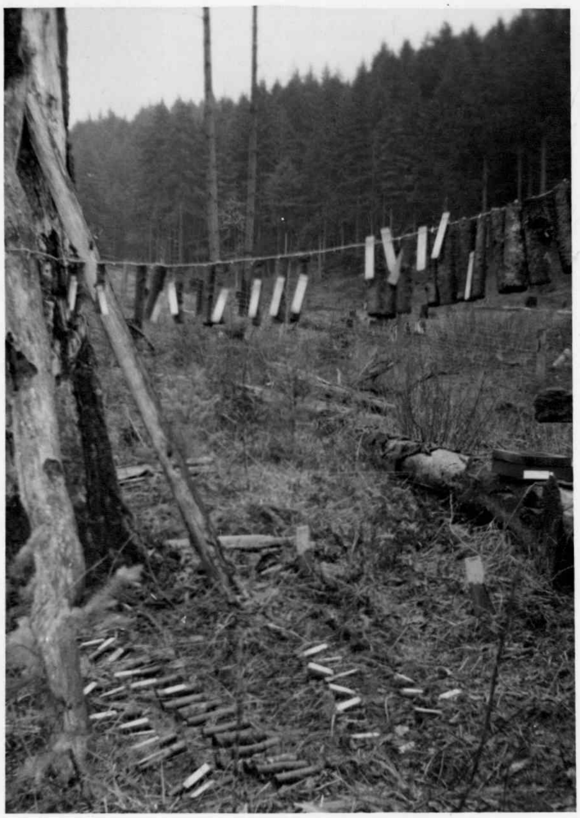

Figure 3

Plot II in the center of an open cut-over area in the Spring 1937.

slash which has been worked over by "Cats" or animals in logging.

Time of establishment--The samples were placed in the McDonald Forest November 26, 1936, with the help of Dr. Hatch. The first weights were recorded one year later on November 16, 1937. This interval allowed the rots to get a start.

Progress of Decay--At intervals visits were made to the plots. Samples were taken from each group in each plot. These samples were brought back to the laboratory and subjected to a temperature of 100°C until the weight became constant. This naturally destroyed all fungal organisms, but the final oven-dry weight did give an indication as to the extent to which the slash had decayed when compared with the original oven-dry weight before the experiment was started in the field.

The following chart is a tabulation of the results. (See next page).

Conclusions--The results do not show a great variation over the three years. A longer time would show more definite differences. However, the results do show that the samples rotted faster in the open cut-over area. Plot II in the open showed an average decrease in weight of 10.76% as against 9.71% for samples in the shade.

The greatest decrease in weight was shown in the sticks half buried. Least decay was apparent in the slash suspended in the air. This demonstrates that lopped slash on or in the ground will rot the faster, which is, strangely, Table

RATE OF DECOMPOSITION OF SLASH

MCDONALD FOREST

Loss is expressed as the per cent the difference between the oven-dry weights of the original sample and the decomposed sample is of the original sample.

Plot I-----In Douglas fir stand

Date	Placement of Samples In the air	On the surface	Half buried
11/16/37	6.67%	6.10%	8.33%
2/18/38	7.81	9.09	9.09
4/ 4/38	7.22	10.63	8.51
5/ 3/38	10.17	8.69	13.04
5/28/38	6.67	8.77	9.09
10/31/38	10.63	18.18	15.22
12/10/38	8.47	10.61	10.94
Averages	8.23	10.30	10.60

Plot II------In open, Cut-over area

Date	In the air	On the surface	Half buried
11/16/37	10.81	12.24	13.21
2/18/38	4.85	5.75	9.09
4/ 4/38	7.94	9.89	8.84
5/ 3/38	8.12	12.16	9.54
5/28/38	7.04	10.71	10.74
10/31/38	11.34	12.36	13.33
12/10/38	9.60	13.27	14.55
Averages	8.53	10.91	11.33

Average for Plot I is 9.71% loss

Average for Plot II is 10.26% loss

contrary to the contention of Stevenson, who said that unlopped slash would rot the faster.(48) Next faster in rate of decay was the slash on the ground which duplicated lopped slash conditions.

It is significant that there are little differences between the averages of slash in the air of both plots. The difference becomes greater for samples on the ground and greatest for slash half buried. It is concluded from this that the controlling factor is the soil which would act as a moisture reservoir, insuring a longer period during which moisture is available. The soil might also act as a modifier of air temperature, offsetting extremes of temperature.

Contrary to the results shown by Stevenson's work in McDonald Forest, this study demonstrated that lopped slash will rot faster than unlopped slash in the air, further, that slash partially covered with humus will rot fastest. It was also demonstrated that slash will rot faster in the open, exposed to sunlight, as in a cut-over area, than in the shade of a forest.

The slash samples hanging in the air did not exactly duplicate conditions of unlopped slash in a forest tree top or large slash capable of supplying water through its vessels from the soil to the fungi. For this reason, perhaps, my results might not be conclusive. The trend is quite obvious however.

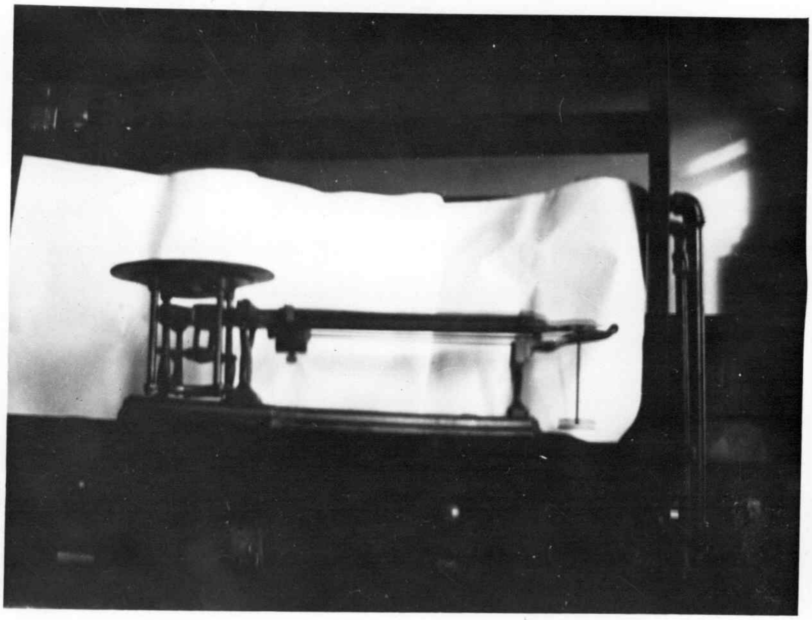

Figure 4

Balance used in weight determinations of air dry samples in the laboratory and also moist slash in the field.

III MOISTURE CONTENT OF SLASH

Moisture is important in slash disposal in that it is often the controlling factor of decay. Too much or too little moisture both have the same result in that decay is inhibited.

Factors of Moisture in Slash

Slash reacts slowly to changes in temperature. As a consequence, it is probably the mean temperature that has the most effect on moisture in slash with the exception of precipitation itself. The effect of higher temperatures is usually an increase in the rate of evaporation.

The greatest factor in the moisture content of slash is precipitation. Slash reacts quickly to increases in precipitation but is slow in giving it up.

The location of the slash has much to do with moisture content. Stevenson showed that limbs attached to the trunk got moisture from the bole.(48) However, distance from the bole seemed to have little effect upon the rate of decay of a limb part.

The type of rot, and also the amount, at work in the slash may influence moisture content. There are two kinds of rots in slash, wet and dry rots.

Wet rots are those characterized by soggy disintegration. These rots dry slowly. They comprise about 10% of the decay on burned areas or as high as 40% on unburned cut-over areas.(45) Ganoderma oregonense is an example.

Dry rots are crumbling in effect, and, when dry, the rotted wood becomes charcoal-like in consistency. Dry rot-infected woods readily absorb and hold water during wet weather. These rots comprise 70% of decay on a cut-over area.(45)

An example of a dry rot is Lenzites sepiaria. Childs found that Lenzites sepiaria increased the absorptive power of wood and considerably increased its water capacity by causing greater porosity of the wood. However, he states that these gains are apparently more relative than absolute.(16) Field studies show that rotten wood and debris become and stay increasingly wet.

Review of a Related Study

T. J. Starker, through his silviculture classes, has emassed statistics on the moisture content of slash in McDonald Forest. His comparisons were between lopped and unlopped slash. Following is his data. The moisture percentages were computed as the difference between oven-dry and wet weights divided by the oven-dry weight.

Moisture of Slash Study
T. J. Starker

Date	Lopped M.C.%	Unlopped M.C.%
Feb. 15, 1934	78.56	61.71
March 7, 1934	88.76	70.98
April 21, 1934	19.95	17.21
May 24, 1934	20.43	16.67
July 18, 1934	13.8	16.5
Aug. 18, 1934	11.7	14.7
Sept. 27, 1934	20.5	20.0
Jan. 15, 1935	45.1	46.5
Feb. 18, 1935	69.3	49.9
March 30, 1935	41.1	23.2
May 15, 1935	17.27	15.65
June 5, 1935	9.1	10.9
July 2, 1935	20.0	19.9
July 30, 1935	13.8	16.8
Sept. 6, 1935	10.7	12.0

This data shows that lopped slash was consistently more moist than unlopped slash with the exception of a period in late July and August during which lopped slash was the drier.

Original Observations

Preliminaries--Moisture content can be expressed as an absolute value or relatively. If all the pieces of slash observed had weighed the same oven-dry, the absolute moisture values would have been most practical to record. However, each piece had an individual weight, therefore, moisture content was best expressed as a relative amount or percent.

To get the percent of moisture in a piece of slash, the oven-dry weight was first obtained. The pieces of slash were placed in the field and weighed at intervals during the period. The difference between each of these wet weights and the oven-dry weights divided by the oven-dry weight gave the moisture content in percent.

Procedure--The collecting of samples, drying to oven-dryness, weighing, and placement of samples for the moisture content study was carried on in conjunction with preparations for the study on the rate of decay. For this procedure refer to the "Original Observations" in the chapter on "Rate of Decay".

Recording of data--The original oven-dry weights were recorded in the laboratory November 25, 1936. The samples were placed in their respective positions just as in the study on the rate of decay. The first moisture content readings were made, the slash samples were weighed in the field so as to get actual field conditions. This necessitated carrying the laboratory scales into the field, bodily. The scales were quite sturdy and easily adjusted so as to give the correct weights. (See Fig. 5 and Fig. 6)

Figure 5

Plot I in a stand of second growth Douglas fir

Shows the scales used in field weighings.

Spring of 1937.

Figure 6

Plot II in an open, cut-over area. Shows the scales used in field weighings. Spring 1937.

Ten samples of slash of varying diameters in each of the positions in Plots I and II were weighed each time. None of the weighing was conducted when the surfaces of the slash were moistened with free water. This was to assure that the weights recorded were actually of wood and "contained" water.

The following table gives the average weights of the ten pieces of slash in each position at various times during the period of study.

Table Showing

Moisture Content of Slash in McDonald Forest

by percentages

Plot I--In stand of Douglas Fir

Date	Hanging in air	On the ground	½ buried	Average
★ 4/3 /37	37.65%	41.40%	50.54%	43.20%
6/4 /37	24.58	15.55	37.09	25.74
11/1/37	35.08	26.51	29.38	30.32
1/11/38	68.27	57.17	59.15	61.53
3/31/38	44.36	35.92	50.25	43.51
4/29/38	31.84	20.37	33.14	28.45
5/ 28/38	22.79	8.53	26.21	19.14
10/31/38	29.83	21.58	25.91	25.77
12/10/38	42.79	31.33	36.40	36.84
	37.45	28.69	38.67	34.94

Plot II--Open, cut-over area

Date	Hanging in air	On the ground	½ buried	Average
★ 4/3 /37	16.57	51.17	46.34	38.03
6/4 /37	2.50	2.81	20.74	8.68
11/1/37	17.17	42.27	30.62	30.02
1/11/38	41.22	61.48	58.90	53.87
3/31/38	26.05	40.98	46.62	37.88
4/29/38	16.67	19.32	35.45	23.81
5/28/38	9.48	9.84	17.38	12.23
10/31/38	25.65	28.69	27.72	27.35
12/10/38	28.34	42.39	44.97	38.57
	20.41	33.24	36.53	30.06

★ Note: Slash one year old at time of first weighing.

IV Summary

The findings of my study have not agreed with the observations of others. Stevenson, in his thesis, maintained that unlopped slash on McDonald Forest rotted faster than lopped slash. The trend of my data clearly indicates that lopped slash rots faster, and, if it gets partially buried in the soil, the slash will rot faster still.

I speak of the "trend" of my data because the three years of this study are not enough for conclusive results.

The combined results of the decay and moisture studies follows:

Correlation of Decay and Moisture Content

in Slash of McDonald Forest

Position	Rate of Decay %	Moisture Content %
In open, ½ buried	11.33	36.53
In open, surface	10.91	33.24
In timber, ½ buried	10.60	38.67
In timber, surface	10.30	28.69
In open, in the air	8.53	20.41
In timber in the air	8.23	37.45

The most moisture and the most decay was found in the half buried slash of each position.

Considering the plots as units, the most decay and the least moisture occured on the open, cut-over plot.

Samples in the air rotted least in both plots.

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IV THE FUNGI RESPONSIBLE FOR THE DECAY

Introduction

The third and last phase of my work was to find out what fungi were responsible for the decay of my slash samples. This study resulted in a comparatively small amount of data but took the most time, study, and equipment in its compilation.

The original plan was to culture the fungi existing in the slash samples and then, by comparison with known cultures from previously identified fruiting bodies, identify the cultured fungi. However, although it was easy enough to culture fungi from the slash, the identification of them was not accomplished. This was due to several reasons. The first reason was my lack of training in the field of microtechnique. A second reason was lack of sufficient time, and thirdly I did not have enough known cultures for comparison.

Although the original object of this phase of the study was not accomplished, certain facts were brought out as will be discussed later.

Procedure

Since the first year of my study, I have collected cultures of fungi taken from the flesh of conks. The object of this was to accumulate known cultures for comparison with the unknown cultures taken from the slash.

Each time slash samples were brought into the laboratory for weighing, an extra sample of slash from each situation was collected for culturing.

situation was collected for culturing.

Cultures are made on a gel containing concentrated food material for the nourishment of the fungi. A culture media must contain a source of energy for the synthesis of cell structure by the organisms.

The media chosen for the fungal cultures is one that experimentation showed to be most agreeable to the most fungi. This media is called malt agar and was prepared in the following proportions:

17 grams agar

25 grams malt extract

1000 cc distilled water

The procedure was to dissolve the agar in one half of the distilled water and the malt extract in the other. The two solutions were then mixed and cooked in an autoclave for twenty minutes at fifteen pounds pressure. After cooking, the liquid was poured into test tubes and stoppered with cotton plugs. After plugging, the tubes were sterilized in the autoclave for twenty minutes at fifteen pounds pressure. Upon cooling, the malt agar gelatinized in the tube. Usually the tube was allowed to cool on a slant so as to cause the malt agar to gel with a larger surface.

The culturing of fungi is an interesting operation. It is a wonderful thing to see beautiful mats of colored mycellium growing out upon the agar from what appeared to be a clean piece of wood.

In order to avoid getting contaminations on the malt agar, many precautions were taken . The room for the culturing was a clean one without air currents. The ideal room is one that can be steamed previously to rid the air of all spores. The work table was thoroughly scrubbed with a five percent solution of mercuric chloride. All work was performed on a cloth soaked in this mercuric chloride solution. All tools used that contacted the wood were first dipped in alcohol and then flamed. Tools were disinfected after every culture.

Tools used were few and simple: scalpel, hammer, 1" chisel, narrow chisel with an extra prong welded on for tweezer action, and a Bunson burner.

The slash samples were split with the large chisel, four cultures were made, two from the heart and two from the sap wood, by digging out slivers with the combination chisel and tweezers. The tubes were opened only long enough to allow the sliver to be shoved into the malt agar, then the tube opening was flamed in the burner and promptly restoppered. After labeling with the number of the slash and the region taken from, the tube was stored on a shelf out of direct sunlight and left at room temperature. In from two to four days a white or colored fuzzy growth usually appeared and developed. After two or three weeks, the cultures were put in an electric refrigerator to slow down growth of the fungi. If allowed to grow normally, the fungi soon dried up the agar and died.

It was these cultures that were to be identified. But for reasons previously mentioned, this was not accomplished.

It was interesting to note, though, that fungi were present in the samples from the first time the samples were brought into the laboratory one year after the study was started. The presence of the fungi was indicated by the fungal cultures the wood slivers produced on the agar. There were sterile cultures though, mostly in the early samples that hung in the air or were flat upon the ground. Pieces half buried showed most evidence of rot. After a year and six months, all samples showed 100% infection by fungi.

Some identification of fungi at work was accomplished by a study of fruiting bodies found on the slash samples or on debris in the vicinity. Polyporus Schweinitzii was found growing from the ground on the edges of the plot in the cut-over area. Polyporus versicolor was found on the samples in the plot under the fir canopy. In the vicinity also was found Fomes roseus, Corticium amorphum, Dacrymyces palmatus, Guepiniopsis sp., Phasidales, Tremellodon gelatinosum, Lenzites sepiaria, Polyporus picipes, and Poria ferruginosa.

Many cultures were infected with Penicillium sp. indicating that this is common. However, it is unimportant in the decay of slash, as is a group of others named in this report. Aspergillis was also present but may have been a contamination.

Fungi in Douglas fir Slash

Research has disclosed that Douglas fir slash is attacked by many fungi. Following is a fairly complete list compiled from the literature on the subject:

Ascomycetes

Penicillium sp.

Ceratostomella pilifera

Pyrenomycetes

Hypoxylon cohaerens

Phacidales

Discomycetes

Chlorosplenium aeruginosum

Guepiniopsis sp.

Basidiomycetes

Tramellales

Dacrymyces aurantia

D. palmatus

Tremellodon gelatinosum

Hymeniales

Thelephoraceae

Aleurodiscus penicillatus

A. subcruentatus

A. amorphus

Coniophora cerebella

Thelephoraceae (cont.)

Corticium Pseudotsugae

C. racemosum

C. vagum

Hymenochaete rugispora

H. spreta

Peniophora carnosa

P. crassa

P. glabra

P. odorata

Stereum Chailletii

S. sanguinolentum

Thelephora terrestris

Sparassis radicata

Hydnaceae

Echinodontium tinctorium

Hydnum Auriscalpium

H. coralloides

H. Erinaceum

H. Ochraceum

Polyporaceae

Polyporus volvatus

Fomes annosus

F. laricis

F. pinicola

F. putearius

F. roseus

F. ungulatus

Polyporaceae (cont.)

Fomes applanatus

Ganoderma oregonense

Lenzites hetermorpha

Lenzites sepiaria

L. trabea

Merulius americanus

M. brassicaefolius

M. lacrimans

Polyporus abietinus

P. adjustus

P. amarus

P. aurantiacus

P. benzoinus

P. cutrifractus

P. frondosus

P. giganteus

P. hispidus

P. Peakensis

P. Pseudotsugae

P. Schweinitzii

P. stipticus

P. sulphureus

Polystictus hirsutus

P. pargamenus

P. serialis

P. versicolor

Coriolus abietinus

Poria carbonaria

Polyporaceae (cont.)

Poria dichroa

P. incrassata

P. Medulla-panis

P. subspadicea

Trametes hispida

T. protracta

T. sepiaria

T. pini

T. setosus

Agaricaceae

Armillaria mellea

Lentinus lepideus

Lepiota xylophila

Pholiota ventricosa

Atrichia glomerulosa

Gelatinosporium abietinum

Helvella infula

Naematelia encephala

Figure 7

A corner of the pathology laboratory, showing the slash fungi cultures in the background.

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