A
Silviculture Project

"TO DETERMINE the SURVIVAL of DOUGLAS FIR SEEDLINGS the FIRST SUMMER after PLANTING."

LOCATION:
Mary's Peak Area
W. 1/4 Sec. 36, T.12S., R.7W., W.M.

by
James C. Manley

Fall term - 1946 and
Spring term -1947
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THE SURVIVAL of DOUGLAS FIR SEEDLINGS

INTRODUCTION

The object of this silviculture problem is to determine the percent of survival of Douglas fir seedlings in relation to exposure. The problem was laid out on three 1/5 acre plots located in the W. 1/4 Sec. 36, T.12S., R.7W., W.M. in Benton County, Oregon.

During the Christmas vacation of 1946, a Forest Service contract was obtained for the planting of this newly burned area, and in coordination with this job the silviculture problem was set up.

The seedlings were planted during the last ten days of December 1946, under adverse conditions. Freezing weather was present during the entire planting period; all the trees heeled in were frozen together. This required the tedious job of separating each tree from the others before it was placed in the planting bag. At this time root injury, that might cause the death of the seedling at a later date, could occur.

In the fall, the planting area had been sowed intermittently with grass seed with the hopes that before summer and prevailing dry spells, the grass would be high enough to provide some cover. At the time of planting, the grass was about an inch high. Considering the possibilities of the deer browsing the grass and trees, two plots were laid out in the grass area and one plot was located in an area not planted by grass, for contrast.
In the final stages of the problem, the deer browsing was so bad that the data obtained could be misinterpreted. Rather than to limit the final analysis to the percent of survival based on exposure alone, the figures have been reconstructed so as to include the effects of deer browsing.
THE PLANTING AREA

In 1945 and 1946 the Siuslaw National Forest sold the timber on the West half of Section 36, Township 12 South, Range 7 West, Willamette Meridian. An area of 140 acres was clear cut, with the exception of a few scattered, unmerchantable trees. The area was logged by the high-lead system. All of the slash was broadcast burned on September 19, 1946, with the exception of a few acres which had a very steep and south aspect. The unburned area was to be planted, at a later date, after some ground cover had become established. The planting was done on a spacing of 7.5 feet by 7.5 feet.

The decision to plant immediately was made for the following reasons, as were determined by the policy of the Siuslaw National Forest: (1) Natural restocking is not a certainty. (2) The time required for good stocking to become established may be cut down from ten or more years to three years.

The slash fire was a little too hot, causing probable loss of seed source within the clear cut area. It is believed that seeds from the trees within the clear cut area and from the edge of the forest on the north side of the area were distributed over the area in the fall and winter of 1946-47.

The yield from the area was 756 M. Bd.Ft.; the K.V. funds from the area were $ .25 per thousand, giving a total of $1,891.00 or $3.51 per acre.

The planting was contracted in small areas. Cost for labor

*The Siuslaw National Forest decided to plant the area with 2-0 stock Douglas fir seedlings in the winter of 1946-47.
on the area on which the three plots are located was $15.00 per acre. The planting stock was procured from the Wind River nursery at a cost of $2.40 per thousand seedlings.

Planting on the area on which the experimental plots are located was done during December 1946, by the one man grub hoe method.

The area is within a game refuge, and some browsing by black tail deer was noticed in the plantation in March 1947.

On the following pages are pictures of the general area and of each plot.
Plot #1 is located on transect "A"...S 80°E, 5½ chains out. It has a level aspect and had no cover at the time of planting. The altitude of this plot is 1,200' and has a 5% slope. It was planted with 150 seedlings. At the time of counting, 50 seedlings were found dead, leaving a 67% survival of planted seedlings.

Plot #1 before planting
Plot #2 is located on transect "B". N 65°E, 7 chains out. It has a SE aspect and had no cover at the time of planting. The altitude of this plot is 1,425' and has a 20% slope. It was planted with 158 seedlings. At the time of counting, 42 seedlings were found dead, leaving a 73% survival of planted seedlings.
Plot #3 is located on transect "C"..N 67°30'W, 2 chains out. It has a NW aspect and had no cover at the time of planting. The altitude of this plot is 1,375' and has a 15% slope. It was planted with 145 seedlings. At the time of counting, 23 seedlings were found dead, leaving an 84% survival of planted seedlings.
THE LOCATION of PLOTS

In February 1947, 3 circular plots of 1/5 acre each, were located in the area. (see map) An initial point was selected on the edge of the logging truck road. It is marked by a #10 spike in the top of a Douglas fir stump, approximately 40" in diameter. From this point three transects were run across the area in such a manner as to give a good selection of conditions for the area. On transect "A", plot #1 is located at an elevation of 1,200', 5½ chains out. On transect "B", plot #2 is located at an elevation of 1,425', 7 chains out. On transect "C", plot #3 is located at an elevation of 1,375', 2 chains out.

Control for the initial point was brought from the corner of sections 35 and 36, Township 12 South, Range 7 West, Willamette Meridian; and sections 1 and 2, Township 13 South, Range 7 West, Willamette Meridian, by traverse with staff compass, abney, and trailer chain. The distance to plots and the bearing of transects from the initial point were determined with the same equipment.

The center of each plot was marked with a wooden stake. On each stake, written in blue keel chalk, is the number of the plot and the transect.

Seedling count in the plots was accomplished in the following manner: A cord, 52.7 feet in length, was looped over the stake that marked the center of the plot. With this cord to determine the extent of the plot, a count of planted seedlings was made on each plot.

To facilitate the location of the initial point, the follow-
ing information is presented: The initial point is best reached by car and can be found by taking the Philomath-Walport highway, traveling 8 miles West, then turning right onto the dirt road and going an additional 1.6 miles. The initial point is marked by a #10 spike driven in the top of a Douglas fir stump approximately 40" in diameter. The stump is located on the lower edge of the logging truck road. (see map) The stump is blazed on the South and East sides. In each blaze, in blue keel chalk, is the inscription "I.P.".

Bearings of the transects from the initial point are as follows: Transect "A" ..S 80°E
    Plot #1 is located 5½ chains out.

    Transect "B" ..N 65°E
    Plot #2 is located 7 chains out.

    Transect "C" ..N 67°30'M'W
    Plot #3 is located 2 chains out.
MAP OF STUDY AREA
W½ Sec 36, T12 S, R7 W. WM
SCALE: 1 INCH = 6½ CHAINS

Legend

- STREAM
- ROAD
- SECTION LINE
- EDGE OF TIMBER

Study Plot O

PLOT 1

PLOT 2

Transsect A

Transsect B

Transsect C
DETAIL DESCRIPTION of PLOT AREAS at TIME of PLANTING

A. LOCATION:

As previously stated, the location of the planting area is in the W. 1/4 of Sec. 36, T.12S., R7W., W.M. The three plots set up are located so each has a different aspect. The whole area is site 3.

B. PLOT DATA:

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>Altitude</th>
<th>Slope(%)</th>
<th>Aspect</th>
<th>Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,200'</td>
<td>5%</td>
<td>level</td>
<td>bare</td>
</tr>
<tr>
<td>2</td>
<td>1,425'</td>
<td>20%</td>
<td>SE</td>
<td>bare</td>
</tr>
<tr>
<td>3</td>
<td>1,375'</td>
<td>15%</td>
<td>NW</td>
<td>bare</td>
</tr>
</tbody>
</table>

C. GROUND COVER:

At the time of planting, there was no cover on the plots. However, the area had been planted with orchard grass seed after burning and it had begun to sprout. This will undoubtedly give a fair cover and moderate protection during the summer months.

D. STAND:

The stand, prior to logging, consisted of a mixed stand of Douglas fir, Western Hemlock, Western Red Cedar and Big Leaf Maple. There were a few cull trees left after the operation was completed. They might have provided a meager seed source within the clear cut area, but the slash fire was too hot, and it killed off all the unmerchantable trees left in the stand.

E. POSSIBILITIES of the AREA:

The area offers good possibilities to restocking because the planted seedlings can be supplemented by seed from the trees
within the clear cut area and from the edge of the forest on the North side of the area. This seed has already been distributed over the area during the fall and winter of 1946-47.
SLOPE and EXPOSURE

The planting area in which the plots are located varies in slope from 5% to 60%. The least slope was found at the higher elevations in the area and on a few occasional benches. The steepest slope was found next to the creeks. The average for the total area was an approximate 20% slope. These slopes were determined by the percent abney hand level.

Plot #1 on transect line "A" is a level plot with an open exposure.

Plot #2 on transect line "B" has a 20% slope with a SE exposure.

Plot #3 on transect line "C" has a 15% slope with a NW exposure.

The planting area has a northern aspect, generally speaking. The sun reaches the area from sunrise to 4:00 P.M.

The level area of plot #1 is reached by the sun from 9:00 A.M. until 4:00 P.M.

In plot #2 the SE exposure receives the sun rays from 8:30 A.M. to 4:00 P.M.

On plot #3 the sun reaches the area, about noon, for an approximate 2 hours.

The above exposure times are approximations and will vary with the length of the day and the time of the year.
The soil type found on each plot consists of a surface soil of Aiken silty clay loam. The surface soil consists of 8-10 inches of brownish silty clay loam. Occasionally the surface soil is broken by an irregular outcropping of basalt and bedrock. The soil on all plots is easily worked and easy to plant. The soil is quite fertile and well supplied with organic matter. In the past, the site was classified as site 3. Plot #3, on the NW exposure, has a large amount of roots in the top soil. This is where the fire wasn't intent enough to burn them out. These roots are not present in plots #1 and #2. The duff on all plots had been moderately burned. The soil on all three plots has been fertile enough to support coniferous growth prior to planting. An occasional slide area was evident and possibly a heavier erosion may result before spring. These areas were planted with the hopes that the slides might be checked.
PLANTING METHODS

The method used in planting was the one man grub hoe system. The spacing of the trees was 7.5 feet between them in each direction. This spacing was varied in compliance with the executed contract. Particular care was taken in the spacing, selection of planting spots, placement of roots, depth of planting, position of stems and firmness.

Any non-compliance with the above could easily cause the death or deformity of a tree. This was also a cause for rejection as outlined in the planting contract. The area was checked as 100% by the Walport District Forest Ranger. As this for a basis, we will assume that all seedlings in the plots were properly planted and if death occurs to any of them, the cause will be from another source.

Attached hereto is a sample contract of the U.S. National Forest Service applicable to this area. This was complied with 100% when the plots were planted.
DESCRIPTION of EQUIPMENT USED

The equipment used in planting was a planting hoe similar to a grub hoe. The handle of the hoe was 3' long, the blade being about 10" by 4", and it weighs approximately 6 pounds.

The sack used to carry seedlings was constructed of heavy canvas to prevent wearing through on the bottom, and it also prevents the drying of the seedling roots. The sack was 16" by 12", having a capacity of 300-350 trees.

Guide posts of Cedar were placed around the boundary to facilitate planting. A stake was placed at the center of each sample plot.

METHOD USED to DETERMINE the NUMBER of SEEDLINGS PLANTED PER ACRE

The number of seedlings planted per acre was determined by the following calculations as required by the forest service contract: Each tree was to have a space of 7.5 feet between it and another tree. Accepting the fact that one acre has the dimensions of 1 chain by 10 chains, then we can say that there are 43,560 square feet per acre. Each tree occupies an area of 56.25 square feet. The total number of seedlings per acre is 774.5, and approximately 155 trees per 1/5 acre plot.
INVITATION, BID, AND ACCEPTANCE  
(SHORT FORM CONTRACT)

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>ARTICLES OR SERVICES</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
</table>
|          | Furnish all tools, equipment, transportation, supervision and labor, except as specified below, for planting seedling forest stock on all plantable areas, within the following described lands, and as shown on attached map:  

Sec. __________ Twp. __________ Rge. _________  

except that the pay areas will not be shown in the specifications but will be the acreage actually planted as determined by the Forest Supervisor or his authorized representative. All planting to be done in accordance with the attached specifications which are made a part of this bid. Special Forest Service planting hoe and bag will be furnished by the Government.  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Quote Price per Acre</th>
</tr>
</thead>
</table>

BID  

In compliance with the above invitation for bids, and subject to all the conditions thereof, the undersigned offers, and agrees, if this bid be accepted within ________ calendar days from the date of the opening, to furnish any or all of the items upon which prices are quoted, at the price set opposite each item, delivered at the point(s) as specified and, unless otherwise specified within ________ calendar days after receipt of order.  

Discounts will be allowed for payment as follows: ________ percent 10 calendar days; ________ percent 20 calendar days; ________ percent 30 calendar days.

Bidder  

Address  

By  

(Signature of person authorized to sign this bid)

ACCEPTANCE BY THE GOVERNMENT  

Accepted as to items numbered  

Name  

Title  

(over)
STANDARD GOVERNMENT FORM OF CONTINUATION SCHEDULE FOR STANDARD FORM 31 OR 33
(SUPPLIES)

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>ARTICLES OR SERVICES</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tree stock will be furnished by the Government and will be delivered to the contractor as needed at the Ranger Station. The work to be started within ___ days and carried to completion within ___ days. Partial payments may be made monthly for 90% of the completed work accepted as satisfactory. Final and complete payment including the 10% withheld from partial payment will be made after completion of the work and acceptance of the entire job by the Forest Supervisor or his representative. Acceptance will be determined by inspection of not less than 5% of the planted trees. Inspection will be on a representative cross section of the planted area and will consist of examining the trees for (1) species, (2) selection of planting spot, (3) placement of roots, (4) depth of planting, (5) position of stem and (6) firmness as described in the specifications attached hereto. Nonconformance with any one of these specifications will classify a tree as unsatisfactorily planted. A tolerance of 5% or 5 unsatisfactory trees per 100 will be allowed. Any amount over 5% will be applied as an equal percentage reduction of the acreage planted. Payments will be made on the basis of the net acreage thus arrived at which will be considered the acreage accepted as satisfactory. (For example, if 10% of the examined trees are found unsatisfactory, the acreage to be paid for will be 5% less than the total acreage planted). Inspections will be made at the request of the contractor and must be made before any payment is approved. The results of an inspection made for purpose of payment will apply only to the area for which payment is to be made. Periodic inspections to determine compliance with specifications for care of trees will be made at the discretion of the Forest Supervisor; non-compliance with specifications for care of trees (Item VI of specifications) will constitute violation of the contract. If violation of the contract occurs in this regard, there will be withheld as liquidated damages, and not as a penalty, 10% of all approved payments otherwise found due under the terms of this contract. Form AD-238, &quot;General Conditions Applicable to Service Contracts&quot; is made a part of this bid.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SPECIFICATIONS FOR TREE PLANTING TO ACCOMPANY BID FORM 33

I. Spacing

Trees should be planted at an average spacing of 7.5 feet between rows and 7.5 feet apart in the rows.

It will be considered more important to plant each tree in the best location for survival and growth than to adhere to uniform spacing. Therefore, trees may be planted as close as 5 feet and as distant as 10 feet apart to take advantage of better planting spots.

Spots to avoid for planting a tree are listed below and any trees planted in such places will be considered unsatisfactory.

1. Mounds of loose soil subject to unusual drying or erosion
2. Abnormal depressions subject to filling with soil or debris
3. Loose rotten wood
4. Spots where soil is burned red by a hot fire
5. Clumps of dense vegetation
6. Rodent colonies as evidenced by holes, runways or mounds of loose soil
7. Within 5 feet of an established natural tree

II. Placement of Tree Roots

The roots of each planted tree should be so placed in the ground that they assume a near natural arrangement. They should not be twisted, tangled, compacted together or turned up at the ends.

III. Depth of Planting

The root cellar of each planted tree should be at or near the ground line. A tolerance of ½ inch high or low will be allowed.

IV. Position of Stem

Each planted tree should stand erect, perpendicular to the horizontal plane, not perpendicular to the slope of the ground.

V. Firmness

Each planted tree should be set firmly in the ground so that if pulled on by the needles, they will come off at the stem without loosening the tree.

Soil around the roots should be so filled in and firmed that there are no air pockets around or adjacent to the roots.

After the soil is firmed around the tree, it should be at its natural level with no depression or mound at or adjacent to the stem.
VI. Care of Trees

Roots of trees must be kept moist at all times by keeping them covered with wet moss or shingle tow.

The supply of trees at the planting site must be kept in a cool shady place, never left exposed to the sun or wind.

If mold, dryness of roots or other evidence of injury is noticed at any time, it should be immediately called to the attention of the Forest Supervisor.

The contractor will do no root pruning, top pruning, or culling. If it should appear that any of these treatments is necessary, the conditions should be reported to the Forest Supervisor and he will arrange to have the necessary work done.
The following tables can only provide a limited amount of information. Since the time of planting, up to the date of survival counting, only 5 months had elapsed. The death rate would be higher, undoubtedly, at the end of the summer months.

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>No. of Seedlings Per Plot</th>
<th>Dead Trees on Plot</th>
<th>Percent of Survival</th>
<th>Slope</th>
<th>Aspect</th>
<th>Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>50</td>
<td>67%</td>
<td>5%</td>
<td>level</td>
<td>bare</td>
</tr>
<tr>
<td>2</td>
<td>158</td>
<td>42</td>
<td>73%</td>
<td>20%</td>
<td>SE</td>
<td>bare</td>
</tr>
<tr>
<td>3</td>
<td>145</td>
<td>23</td>
<td>84%</td>
<td>15%</td>
<td>NW</td>
<td>bare</td>
</tr>
</tbody>
</table>

*Originally this table was set up to show the percent of survival in relation to exposure, but the unforeseen factor of deer browsing makes the table a fallacy. Consequently, higher fatalities will result, thus reducing the percent of survival. In the process of browsing, the deer broke the seedling roots, thus causing death.
Table 2

Seedling Loss Due to Deer Browsing

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>No. of Seedlings Per Plot</th>
<th>Dead Trees on Plot</th>
<th>Browsed Trees</th>
<th>Total Unaffected Trees</th>
<th>% of Survival Including Living Browsed Trees</th>
<th>% of Survival Excluding Living Browsed Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150</td>
<td>50</td>
<td>57</td>
<td>43</td>
<td>67%</td>
<td>29%</td>
</tr>
<tr>
<td>2</td>
<td>158</td>
<td>42</td>
<td>76</td>
<td>40</td>
<td>73%</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>145</td>
<td>23</td>
<td>0</td>
<td>122</td>
<td>84%</td>
<td>84%</td>
</tr>
</tbody>
</table>

* To be considered is the probability that many of the seedlings will die in the future as a direct result of deer browsing. This will cause a lower rate of survival than is shown in column 6, and a higher rate than is shown in column 7. The exact percent will have to be determined at a later date.
SUMMARY

Exact statistics cannot be obtained from data on survival of Douglas fir seedlings as in relation to exposure, if young trees are planted in a cover crop of grass. As shown by the preceding tables, the deer browsed so many trees that no absolute conclusions on survival could be obtained.

However, this project has not been in vain. Data obtained showed that when seedlings are planted in an area where a cover crop exists, deer will be attracted to the planted area by the grass and will increase the possibility of browsing the young trees. The data found, shows that in plots #1 and #2 which were located in the heavy grass cover, had a survival of approximately 27%, whereas in plot #3, where no grass was growing, the survival was 84%. From this information, we can conclude that areas to be planted with Douglas fir seedlings should not be previously planted with grass seed because deer will destroy approximately 75% of them.
COST of PROJECT

A. Equipment cost for planting
   No equipment cost was necessary,
   all tools were furnished by U. S. F. S.  $00.00

B. Man hours
   Field work
   5 trips to the planting area
   8 man hours each trip
   Total: 40 man hours @ $1.00 per hour 40.00

C. Cost of pictures 3.50

D. Travel expenses
   Total mileage: 60 miles @ $ .10 per mile 6.00

Total cost  $85.50
GLOSSARY

In order to avoid misinterpretation of terms, these pages provide adequate definitions for an easier and clearer understanding of this project.

Degree of Burn:

**Hard Burn**—A fire which completely burns all humus and duff from the land, leaving it in a state of barrenness.

**Moderate Burn**—A fire that partially destroys the organic material in the soil, but deoids the ground of all surface litter.

**Light Burn**—A fire that only burns the limbs and leaves from the slash, and does not damage the soil.

**Aiken Soil**—A surface soil of silty clay loam in its typical development. It consists of 10-12 inches of red to brownish-red silty clay loam. Its sub soil is red in color.

**Basalt Rock**—A dark colored rock of volcanic origin.

**Duff**—A ground cover of decayed vegetation in the forest.

**Humus**—A brown or black material formed by partially decayed forest matter. It is the organic portion of the earth.

**Percent Abney**—A hand level, used in measuring slopes, whose scale is graduated in percents.

**Planting Hoe**—As used in this project, a hoe with a long slender blade and a 3' handle.

**Chain**—A surveyors chain 66' in length. It has 100 links, each link being equal to .6'.
Exposure—The position of the ground in relation to the sun rays and the amount of sunshine received per day.

Seedling—A small tree that has grown 2 years in a seed bed without being transplanted.

Plot—As referred to in this project is a circular area having a radius of 52.7 feet, and an area of $\frac{1}{5}$ acre.

"Heeled in"—A term referring to the temporary planting of seedling in the ground. Usually, a small ditch is dug and the trees are placed in it at a $45^\circ$ angle with the roots covered with dirt. A shady place is the best location for a heeled in place.