SOME ECONOMIC ASPECTS OF

SEED SOURCES

by

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# INTRODUCTION

Virgin timber cannot be depended upon to furnish forever the wood product needs of this country. Increasing amounts of second growth Douglas Fir are being cut. At some future date wood using industries must depend for their source of raw material on trees which have not as yet started to grow. It is important then that forest land remain in a productive state. Many forest industries have recognized this, and are leaving a portion of the timber to provide a seed source.

The Oregon Forest Conservation Act requires that a logging operator leave enough trees to seed the area he has logged, or pay a penalty, which is used to finance artificial restocking.

It is the purpose of this thesis to review the types of seed sources which may be left in the Douglas Fir Region, and the costs which these seed sources may entail.

# SOME ECONOMIC ASPECTS OF SEED SOURCES

## I. SEED SOURCES

The Oregon Forest Conservation Act provides that
both the operator and land owner shall comply with such
rules and regulations as may be promulgated by the state
forester and approved by the State Board of Forestry, and
shall in any event either leave reserve trees of commerc-
ial species deemed adequate by the State Board of Forestry
under normal conditions to maintain continuous forest
growth or provide adequate restocking to insure future
forest growth.

This provision shall be deemed to have been complied
with in the forested areas situated west of the summit of
the Cascade mountains within the state of Oregon if the
equivalent regulations promulgated by the state forester
pursuant thereto are complied with, or if there shall
have been reserved and left uncut not less than 5 per
cent of each quarter section (160 acres), or fractional
part thereof, well stocked with commercial tree species
of seed-bearing size.

The foregoing may be accomplished by leaving, until
the cutover areas for which the seed source was left are
restocked in a manner satisfactory to the State Board of
Forestry, (a) marginal long corners of timber between
logged areas, or (b) strips of timber along creeks,

across valleys, along ridges, or natural fire breaks, or (c) staggered settings.

This provision shall also be deemed to have been complied with by leaving seed trees of commercial species at least 18 inches in diameter breast high, in the ratio of two trees per acre, well distributed over the area cut.

The term "seed tree" shall mean a live, wind-firm tree of commercial species and of seed-bearing size, possessing a relatively full crown.

In the event that any operator shall desire to adopt other practical methods than those listed for providing for future forest growth within the meaning of the Act, including but not limited to artificial restocking or partial or selective cutting of the entire stand, said methods may be substituted if 30 days prior to the commencement of operations said operator shall have submitted in writing to the state forester such substitute plan, and unless, prior to the commencement of said operations, the state forester shall have disapproved the same.

"Immediately upon the detection of any violation of the foregoing provisions of this act the state forester shall notify the operator and landowner or his agents in writing of his finding that the harvesting operations have not been or are not being conducted in accordance with the provisions of this Act, specifying in which respects said operator has been delinquent, and directing such steps as he shall deem necessary to assure future compliance with the terms and provisions of this act with respect to the entire operation. If said

operator so notified shall fail, neglect or refuse to
conform to the practices directed in said notice, or if no
appeal has been taken as provided herein within 30 days
after such notification, then the state forester shall
have the power and it shall be his duty to order the
operation discontinued until the operator or landowner
has given satisfactory assurance that he will resume
operations in compliance with the provisions of this act
and furnish cash deposit or bond approved by the state
forester, in an amount as set by the state forester,
which amount shall not exceed eight dollars ($8.00) per
acre for that portion of the area which through his
failure to carry out the provisions of this act does not
have sufficient source of seed to restock the area.

"Such cash deposit or bond shall be furnished to
insure that the owner or operator will artificially re-
stock the area for which the money was collected within
five (5) years of the date of completion of the harvest-
ing operations.  In the event that at the end of the said
five (5) year period the operator or landowner has not
adequately artificially restocked the said area and if
it has not become adequately restocked through natural
means, the state forester shall have the power and it
shall be his duty to enter upon said lands and to take
such steps as are necessary to correct the conditions
caused by the violation of this act, and he shall keep
full records of the costs incurred therefore; provided
that the maximum amount to be expended by the state
forester for said purposes shall be determined at a
rate not to exceed an average of eight dollars ($8.00)
per acre for each quarter section or fractional part
thereof upon which correction of the conditions caused
by the violation of this act shall be necessary.

"Upon the completion of all steps necessary to re-
pair the damage caused by said violation, the state
forester shall notify the delinquent operator or land-
owner or their agent, in writing of the costs incurred
therefor, and thereupon the said cash deposit shall be
forfeited, or so much thereof as the forester shall have
found necessary to correct the conditions caused in said
area by said delinquency, or if a bond has been posted
in lieu of a cash deposit, the sureties on said bond
shall be liable for all costs incurred hereunder, pro-
vided that the operator or landowner shall have failed
within thirty (30) days after notification in writing
by the said state forester, to pay the amount of money
for which he has posted bond, or so much thereof as the
forester shall have found necessary to correct the con-
ditions caused in said area by said violation." (1)

These seed source requirements appear to be minimum

standards if judged by studies made by Isaac. (2)

"An average old-growth tree left after logging pro-
duces about a pound of seed during a good year. Eight to
ten times that amount would ordinarily be required to seed
up a single acre. Single seed trees at the rate of approx-
imately two per acre on national forest timber sales have
been found to do some reseeding, but they are by no means
adequate.

"Our studies indicate that seventy-five per cent of
these trees are lost within ten years after logging, and
those that are not destroyed by logging or slash burning
either windfall or die from exposure, insect injury, or
decay.

"The best assurance of any adequate seed supply is
a nearby block of uncut timber.

"Measurements of seed flight, and seedling studies in
cut over and old burns indicate that an area will seed up
for an average distance of a quarter mile. However, air
movement is so variable that no positive distance of seed
flight can be set up for a specific area."

From a study made after the first Tillamook fire,

Isaac (3) found that nineteen times as many trees became

established in 1935 within ten chains of seed trees as

did those at greater distance. He found that the area

within eight chains of green timber was fully stocked and

an area from eight to sixteen chains was partially stocked.

Figure 1.  Typical long corner left for seed source on 320 acre area:
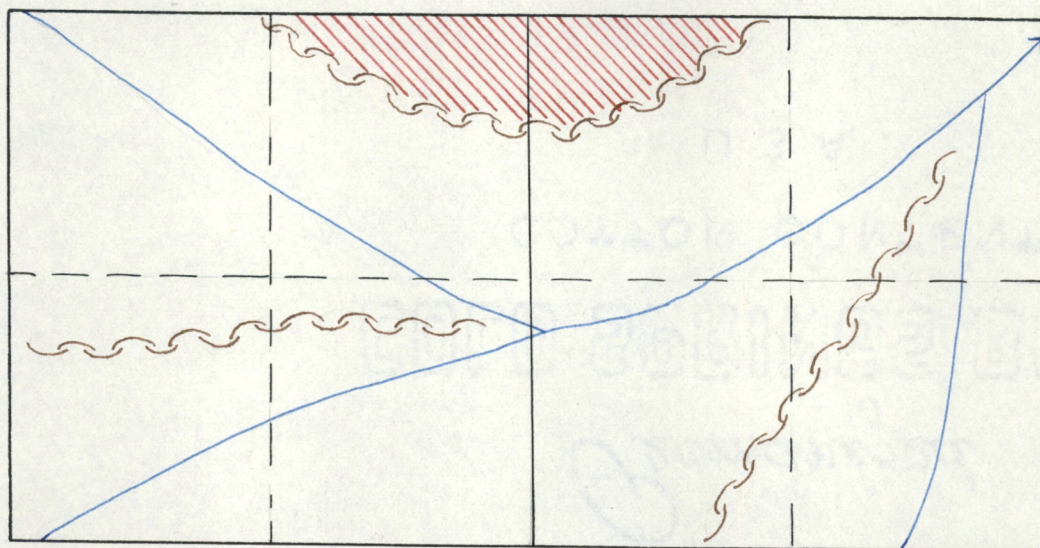


Logging operators will leave seed source either to comply with the Oregon Conservation Act or because they actually desire to keep their lands producing trees.

The long corners left in Figures 1 and 2 would meet the requirements of the Conservation Act but would not be likely to fully stock more than one-third of the area from which the timber was taken.  These illustrations would not satisfy a company which wanted full stocking on the entire area in a short period of time.

Figure 2.  Long corner left for seed source on 160 acre area.
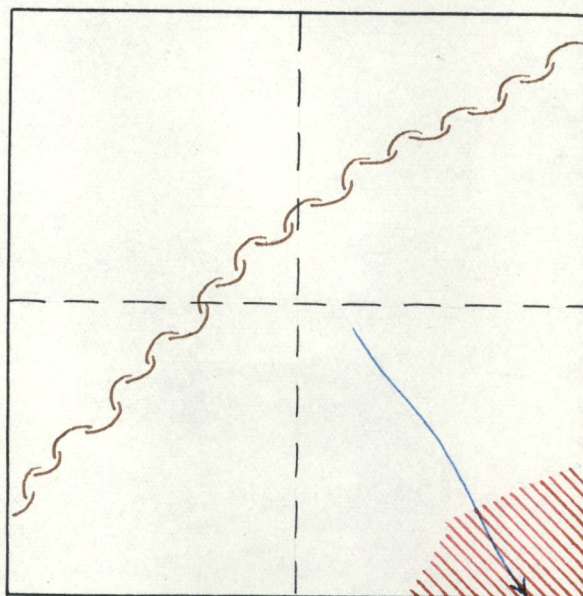


If long corners are truly marginal they would be no expense to an operator as a seed source.

Figure 3 illustrates the timber value that could be left in the long corner seed block of Figure 1 if it comprises five percent of the total area.

A combination of high volume per acre and high stumpage value would hardly leave a long corner marginal, even with added logging expense.  It would cost $2000 to plant the area at $25 per acre, or $640 if paid to the state at $8 per acre.

Figure 3. Timber value left in a long corner of four acres with various volumes per acre and stumpage values per thousand board feet.

| Volume per acre in M board feet | Stumpage values per M | | | |
|---|---|---|---|---|
| | $5.00 | $8.00 | $12.00 | $20.00 |
| 10 | $200 | $320 | $480 | $800 |
| 20 | 400 | 640 | 960 | 1600 |
| 30 | 600 | 960 | 1440 | 2400 |
| 40 | 800 | 1280 | 1920 | 3200 |
| 50 | 1000 | 1600 | 2400 | 4000 |
| 60 | 1200 | 1920 | 2880 | 4800 |

In many areas in the Douglas Fir Region there are stands of which a part of the trees are defective. In these stands there are generally ample defective trees left after logging to provide a seed source. This is the type of stand in which scattered seed trees meet the requirements of economics and silviculture.

Merchantable scattered seed trees left on steep ground will in many cases be uneconomical to go back and take out. If they are taken out much of the reproduction which they fostered will be destroyed. In the smaller second growth stands there are other factors which make the practice of leaving scattered merchantable seed trees undesirable.

Trees in fully stocked stands will have a small crown with which to produce seed and according to Isaac (2) many of them will be lost. These trees under 28" which

are killed or windthrown would not be expected to be salvable. (4).

## II. STAGGERED SETTINGS

Leaving blocks of timber in the form of staggered settings provides probably the best seed source for the even aged stands found on rough terrain. These blocks may take the form of staggered settings left along roads when the main portion of the timber is taken out, or of strips of timber left by staggering road spurs.

Which of these forms the seed blocks should take would depend on topographic conditions, road building and road maintenance costs, uniformity of the timber, financial condition of the logging company, the number of years it is expected to take for reproduction to cover the logged area, rate of interest at which the company can borrow money, and the method of figuring road costs for income tax purposes.

Seed blocks must be left for a period of ten years to insure reproduction on the logged portions in some areas.

In figure 6, 23 percent of the timber has been left in staggered settings for seed blocks. The mainline road costs in this illustration would either have to be depreciated over 77 percent of the timber or 23 percent of the road cost would have to be carried for ten years before it could be written off.

A company which is making a good profit would probably want to do the former for income tax purposes.

A company, on the other hand, which was not making a profit would be reluctant to carry 23 percent of the cost of that road for ten years.

In order to come back and log the staggered settings left in Figure 6, 436 stations of the original constructed road system are used again. Figure 4 illustrates the effect that compound interest will have in increasing the logging cost of the 23 percent of the timber left in staggered settings.

Figure 4 shows various combinations of volume per acre, original road costs per station ($75 being taken as an average dirt road cost and $250 for rocked roads), interest rates of 4 percent and 6 percent, and length of time between cuts of five years and ten years.

A ten year period between cuttings and a 16 percent interest rate would appear to be the most common combination. An increase in the original road cost would increase the interest cost proportionally while an increase in the volume per acre will decrease the interest cost proportionally on the timber left in staggered settings.

Figure 4.   Interest charges per M board feet on roads illustrated in Figure 6 on timber left in staggered settings.   Four hundred thirty-six stations of road used in initial logging are used in second phase.

| Volume per acre M board feet | Road cost $75 per Station | | | | Road cost $250 per Sta. | | | |
|---|---|---|---|---|---|---|---|---|
| | 4% 5 yrs* | 6% 5 yrs | 4% 10 yrs | 6% 10 yrs | 4% 5 yrs | 6% 5 yrs | 4% 10 yrs | 6% 10 yrs |
| 10 | $.28 | $.44 | $.62 | $1.02 | $.93 | $1.46 | $2.07 | $3.41 |
| 15 | .19 | .29 | .41 | .68 | .62 | .97 | 1.38 | 2.27 |
| 20 | .14 | .22 | .31 | .51 | .47 | .73 | 1.03 | 1.70 |
| 30 | .09 | .15 | .21 | .34 | .31 | .49 | .69 | 1.14 |
| 40 | .07 | .11 | .15 | .25 | .23 | .36 | .52 | .85 |
| 50 | .06 | .09 | .12 | .20 | .19 | .29 | .41 | .68 |
| 60 | .05 | .07 | .10 | .17 | .16 | .24 | .34 | .57 |

* - Time between cuttings.

Figure 5 is an alternate plan of road location and seed block to that of Figure 6.

It requires the same amount of roads to log the entire area, but the roads used to log the seed blocks will not have to be built until the seed blocks are ready to be logged.  This requires less road construction during the initial phase of logging, and eliminates the interest costs illustrated in Figure 4.

An item which is hard to estimate ahead of time is road maintenance costs.  After the initial phase of logging (Figure 6) the roads to be used again must either be

maintained every year or repaired before the second phase
of logging begins. If the initial cutting period were
three years, seven years would pass before the roads were
again used for logging.

In areas of heavy rainfall considerable damage might
be done over a period of seven years.

TIMBER LOSS IN STAGGERED SETTINGS

When timber, especially even aged second growth, is
opened up by logging, severe losses by windthrow, break-
age, sun scald, slash fires, and insects may result.
These losses should be negligible in stands over 150 years
old; even if these trees are killed or windthrown they
would still be salvable if the seed blocks are taken out
ten years after the initial logging. Trees of small dia-
meter, because of the high percent of sap, would probably
be lost (4).

In one area four miles southwest of Blodgett vary-
ing losses had occurred along edges of timber opened up
by logging six years ago. The stand was ninety year old
Douglas Fir, and averaged 19,250 board feet per acre. On
some of the exposed timber edges there were few dead or
windthrown trees. Along one strip, however, there was
an average loss of 1500 board feet per 100 lineal feet of
timber edge exposed.

This loss was in the form of windfalls and dead trees
from 12 inches to 24 inches in diameter breast high,

apparently either as a result of being opened by logging or by the slash fire which followed.  Although the tree trunks did not show fire scars some of the roots had been burned slightly.

The trees appeared to have been dead for three to six years.  At distances greater than one hundred feet from the cutting edge this loss was not noted.

While the above-mentioned example is not to be considered as average or normal it is a factor which will become increasingly important as loggers turn to second growth timber.

The example cited, of a loss of 1500 board feet per 100 feet of timber edge exposed, if applied to Figure 6 would result in a total loss of 964,500 board feet.  This is 8.7 percent of the timber left in the seed blocks, and 2.5 percent of the total amount.  If applied to Figure 5 it would result in a loss of 6.1 percent of the seed block timber, and 2.7 percent of the total.

Conceivably, in this example, additional logging expense could be incurred to better locate seed block boundaries to protect them from windthrow, and to protect seed blocks during slash fires.

SUMMARY:

Of the types of seed sources which may be left by logging operators:  scattered seed trees, long corners, staggered settings, or strips of timber, each appears to

have a place where it is economically suited. The weighing
of economics, as well as silvicultural factors, will deter-
mine which type of seed source shall be left. The present
condition of high operating profits and high income taxes
is contributing greatly in providing adequate seed sources.

Further study is needed on road maintenance costs
and upon the losses incurred on stands of second growth
which are opened up by logging. The present experiments
being carried on by the Forest Service at Cascade Head
should help.

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FIGURE 5

SEED BLOCK BOUNDARY ▬ ▬ ▬    1ST PERIOD ROADS ▬▬▬    2ND PERIOD ROADS ▬ ▬ ▬
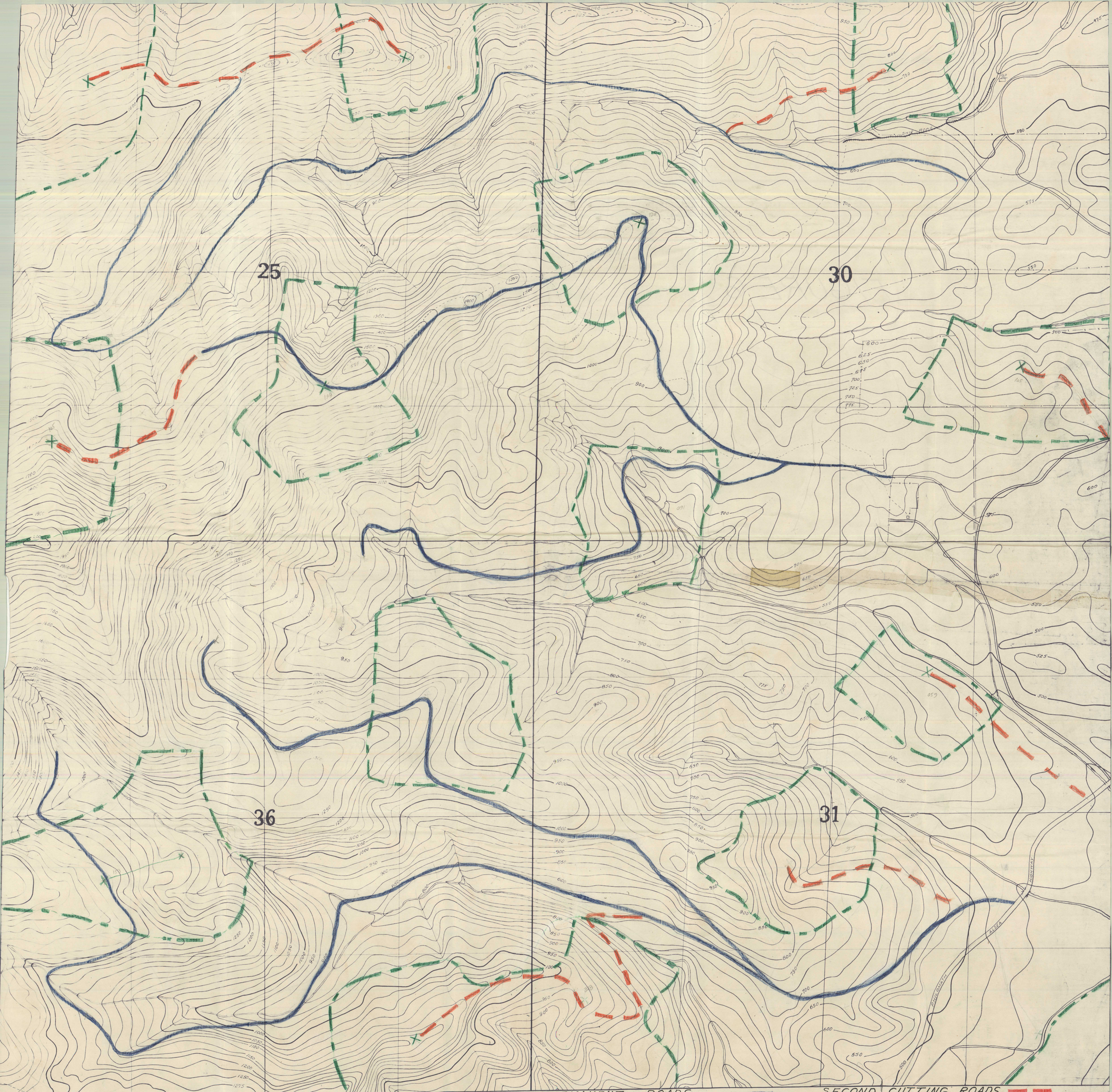
25    30

36    31

25     30

36     31

FIGURE 6

SEED BLOCK BOUND.          PERMANENT ROADS          SECOND CUTTING ROADS