U. S. FOREST SERVICE

Pacific North West Research Note

FOREST AND RANGE EXPERIMENT STATION · U.S. DEPARTMENT OF AGRICULTURE · PORTLAND, OREGON

Number 92 Portland, Oregon November 1953

AN ESTIMATE OF THE AMOUNT OF ROAD IN THE STAGGERED-SETTING SYSTEM OF CLEARCUTTING

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One question frequently asked by foresters in the Douglas-fir region is: "How much land is taken out of forest production by logging roads and landings?" The final answer is not known, but a rough estimate recently prepared for a sizable portion of the H. J. Andrews Experimental Forest may be useful as a tentative figure. The experimental area is located about 50 miles east of Eugene, Oregon on the Willamette National Forest and is fairly typical of the old-growth Douglas-fir forests that are found on steep watersheds in the Oregon Cascades.

A forestry-logging plan covering 8,800 acres within the experimental forest furnishes an estimate of total road mileage needed for a permanent road system. The 12 clearcuttings, where logging has now been completed, provide a measure of the area actually disturbed during both roadbuilding and landing construction.

Area Disturbed

For the 12 clear-cut units, which range in size from 21 to 54 acres, measurements were taken on road width, including cut and fill, and on the area of cuts and fills resulting from the building of landings. The area disturbed solely as a result of high-lead or tractor yarding was excluded.

A summary of these measurements (table 1) shows that 8.8 percent of the total area in the 12 units was disturbed in roadbuilding and an additional 3.6 percent in the construction of landings. Together the two types of construction affected 12.4 percent of the total cutover area.

Table 1.--Number of landings, length of road,[1/] and percent of area disturbed in 12 clear-cut units on the H. J. Andrews Experimental Forest

Unit	Acres	Landings		Roads		Total percent of unit disturbed
		No.	Percent of unit disturbed	Length in miles	Percent of unit disturbed	
2-B	21	1	5.7	.14	2.7	8.2
3-B	21	2	3.3	.56	17.3	20.6
1-C	28	2	3.5	.60	13.5	17.0
2-A	28	2	6.6	.30	5.6	12.2
2-D	33	4	6.1	.54	14.6	20.7
2-C	36	2	3.8	.26	4.5	8.3
1-D	37	2	2.2	1.02	23.1	25.3
1-E	39	3	3.8	.04	0.7	4.5
1-B	40	4	4.5	.69	13.0	17.5
2-E	43	1	1.7	.10	2.4	4.1
3-C	50	3	2.2	.61	12.6	14.8
3-A	54	2	3.0	.15	1.2	4.2
Average per unit	35.8	2.3	3.6	.41	8.8	12.4
Per sq. mile	640	41.7	3.6	7.42	8.8	12.4

1/ All roads in the 12 units were the U. S. Forest Service 1-lane Class EE Standard, with 16-foot roadbed, 12-foot gravel surface, 3-foot ditches, and intervisible turnouts.

It should be noted that the road density on these first units is unusually high (7.42 miles per square mile), because they include a large proportion of the climbing roads--those needed to reach the upper slopes. For the entire area (8,800 acres) covered by the present forestry-logging plan, the road density averages only 5.19 miles per square mile. This includes not only the roads needed for the first series of clear-cut units, but also those now located but still unconstructed that will be needed to cover the entire area during the first rotation. The roads are located so that yarding distances will average slightly under 700 feet.

The estimated proportion of the total forest area that will be disturbed through road building alone then becomes 6.2 percent

$$\left(\frac{5.19}{7.42} \times 8.8 \text{ percent}\right).$$

Since the proportion of area affected by landing construction may be expected to remain close to the average for the 12 units measured (table 1), an estimate of total area disturbed from both causes over the entire tract would be 9.8 percent (6.2 + 3.6).

Effect on Productivity

Of more importance than the disturbed area figures is the total loss in productivity that may be expected over the entire rotation. Obviously, the total area disturbed is not entirely removed from forest production, even though bare subsoils are generally exposed. A high percentage of abandoned road grades and landings do reforest even though there may be some reduction in site quality.

The proportion of the planned road-system that will be kept permanently free of forest is, of course, not known at the present time. Likewise, the probable losses due to slow restocking, poor moisture relationships, and soil compaction are a matter of conjecture. Nevertheless, an estimate of probable loss based on certain broad assumptions may be useful in the preparation of longtime forest management plans.

Such an estimate was attempted for the H. J. Andrews Experimental Forest. In this case, average width of roadbed, including ditches, is 19.4 feet. Average total width of road, including cuts and fills, is 52.9 feet. Limited observation indicates that cuts will probably reforest poorly and fills rather well. Visiting European foresters have further reported that for managed stands the encroachment of roots and crowns is almost complete at the end of the rotation on roads up to 9 feet wide. Hence an average encroachment of 4.5 feet is assumed for the rotation.

Assuming that:

1. Loss of productivity on fills is one-fourth
2. Loss of productivity on cuts is three-fourths
3. Proportion of fills to cuts is 3 to 2, and
4. Encroachment of roots and crowns into the roadbed proper averages 4.5 feet,

a fairly simple computation will show that a strip of forest 30 feet wide will represent the total loss in productivity for the area disturbed along a single road. Since there will be 5.19 miles of road per square mile, the total forest area lost to production as a result of roads would average 18.85 acres per square mile, or 2.9 percent.

If we further assume that the loss in productivity on landings is one-third, the area removed from production as a result of landing construction would be 3.6 (table 1) ÷ 3, or 1.2 percent of the forest area.

The total expected loss in productivity from both roads and landings can then be placed at 4.1 percent.

This figure is high enough to warrant consideration in the preparation of forest management plans. It is lower, however, than would be guessed from casual observation of the tremendous amount of earth moving that takes place during roadbuilding and logging of old-growth Douglas-fir on steep watersheds.