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A SURVEY OF
CHRISTMAS TREE PRODUCTION
ON PRIVATE LANDS
IN WESTERN MONTANA


by

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B.S., University of Washington, 1942

Presented in partial fulfillment of the
requirement for the degree of
Master of Science
in Forestry

School of Forestry
Montana State University
1948

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of Examiners


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CHAPTER I

IMPORTANCE OF THE INDUSTRY AND OBJECTS OF THE STUDY

Introduction

In a span of twenty-one years, the Christmas tree industry of Western Montana has become a million dollar industry. Now called the "Christmas tree capital of the world", Eugene founded the industry with the shipment of one car, or about 4,000 trees in 1926. Since 1940, shipments from Western Montana have been in excess of 500 cars, or 2,000,000 trees yearly. In 1946, a record production of approximately three and one-third million trees were harvested. Almost 80 per cent of this production came from Lincoln and Flathead counties.

The number of trees cut per year is no more significant than the value of the employment provided. For example, Ross Williams, Regional Forester of the Soil Conservation Service, has estimated¹ the total returns to farmers in 1946 to be about \$784,000. Of this total, an estimated \$147,500 was for operations over and above the value of the trees in the woods. In other words, approximately 19 per cent of the total returns to farmers came from employment with shipping companies after the trees had been cut, yarded, skidded, sorted, and were ready to be hauled to the shipping point. It is this employment for the whole

¹ Ross A. Williams, "Christmas Trees -- A Profitable Farm Crop", (unpublished paper), 1947, p.7.

community which makes the industry so important to Western Montana.

Christmas tree production is ideally timed for farmer participation. Most other farm products have been harvested when cutting starts in early October. It provides additional use of equipment and hired help. It provides work and needed revenue for the entire family, thus becoming an important adjunct to the farm economy.

Some segments of public opinion have long decried the cutting of young trees for Christmas tree use. This industry has been called the "last raid on the Rockies", our last "frontier" of forest waste and depletion. Actually, proper harvesting of Christmas trees is good forestry. Land suitable for Christmas trees is usually poor land for saw timber growth. Douglas-fir, the species cut in this region for Christmas trees, produces low quality timber. For small owners and farmers, the Christmas tree is the best forest product on his land. It is about the only forest product crop in the region which may be harvested regularly at short intervals. Thus it satisfies the owner's need for regular financial returns from his land. It is good land management to produce a crop more valuable than many agricultural crops, on land unsuitable for timber growth or pasture.

Are private owners of Christmas tree land killing the goose that laid the golden egg? Good Christmas tree land in the heaviest producing areas of Lincoln and Flathead counties has not been readily available since 1940. The number of trees cut per year have more than doubled in

the last decade. Production statistics, published yearly since 1932 by the Northern Rocky Mountain Forest and Range Experiment Station, show that an average of 83 per cent of the total production in the last ten years has been cut from privately owned lands. The increase in acreage of privately owned lands devoted to Christmas tree production during this period is not known. If the area of land in private ownership cut for Christmas trees has increased appreciably, then the intensity of cutting has been fairly constant. The sharp rise in value of Christmas tree land, however, indicates that demand for such land has been heavy in relation to supply. This type of land was often originally purchased from the county for taxes for \$1.00 to \$1.50 per acre. Today, tracts of land suitable for Christmas tree production are not readily available, even at \$10.00 to \$15.00 per acre. This pressure for expanded production has been reflected in increased bidding on public lands, both Federal and State. Thus, there is a probability that production on private lands under present cutting practices is approaching the limit of supply at least in areas where the industry is now centered. On some lands cutting may be exceeding the sustained capacity of the land.

Objects of Study and How the Survey was Made

Considering the importance of the industry, its significance to farm economy, that proper harvesting is good forestry, and the possibility that private operators might be cutting themselves out of business, a systematic study of privately owned Christmas tree lands was made during the fall and winter of 1947-48. Objects were to determine (1)

how the industry is conducted, (2) what type of land is suitable for Christmas tree production, (3) what are effective management practices, (4) what are yields under present practices, and (5) what yields are under management.

The survey was conducted on private lands lying in six major producing areas. The areas were: (1) Eureka-Fortino, (2) Libby, (3) Plains-Thompson Falls, (4) Kalispell-Bigfork, (5) Somers-Dayton and (6) Missoula-Bitterroot. Producers owning land devoted to Christmas tree production were contacted in each area. An effort was made to choose the best operators in the area. The results of the survey consequently give a picture of practices and methods employed by the leaders in the industry. About 10 per cent of total production is represented.

Contact with these growers was made by personal interview. Whenever possible a portion of the producing ownership was covered with the owner. In addition to interviews with growers, contacts were made wherever possible with buyers, professional cutters and others directly connected with various phases of the industry.

A total of twenty-seven growers were interviewed, and twenty of the areas owned by these producers were covered in considerable detail. Two forms were used to record the data obtained. One form was used for the personal interview, and data recorded concerned ownership, size of area, methods of cutting, methods of marketing, cultural practices and management and problems. The other, was a form used for collecting of data while on a particular part of the ownership. Data recorded covered

topography, timber types, reproduction, fire and logging history, harvesting methods, pressures of disease, and the history of cutting and yield of the area. Copies of these field forms are included in the Appendix.

Review of Literature and Past Work

The Northern Rocky Mountain Forest and Range Experiment Station has published annual statistical reports on Christmas tree production since 1932. These reports give the only reasonably accurate statistics on the Christmas tree industry in Western Montana. They include statistics on the total production by counties and by land ownership --- national, forest, state, and private. Shipping data, and whether by rail or truck, are also given. These reports call attention to general trends indicated by the production figures.

The recent publication, "Management Practices for Christmas Tree Production", by C. A. Wellner, and A. L. Roe of the Northern Rocky Mountain Forest and Range Experiment Station is based on field observations and studies of S. H. Larson and others. In it are given some of the practices found to have been successful in Christmas tree culture. Excellent photographs show before and after treatment of trees which have been pruned for better growth, and stumps which have been trimmed for production of "limb trees".

Ross Williams, Regional Forester, Soil Conservation Service, has written a paper, (unpublished) "Christmas Trees --- A Profitable Farm Crop".

He presents the industry from the farmer's standpoint, advocating practices which he has found to be successful. His recommendations are based on close observation of the industry for over ten years.

Other bulletins and articles, published in other states were studied. A list of these publications has been included in the Bibliography.

The need for information of the Christmas tree industry in West Virginia has been recognized for some time. Many rangers and supervisors of the Forest Service and personnel of the Soil Conservation Service also have gathered information about the industry. Of these men, S. H. Larsen, former ranger of the Ant Plains District on the Foothold National Forest in Lincoln County, is one of the foremost contributors of information covering the industry. It was on this district that some of the first sales of Christmas tree stamps on public lands were made. The United States Forest Service was the first to formulate cutting regulations which have been more recently adopted by the larger private owners as a guide in avoiding slashings and subsequent wastes.

In 1941 the Forest Service recognized the need for management data, which would point the way to sustained production of Christmas trees. The Wild Hill and Tramon creek drainages on the Flathead National Forest were designated as experimental Christmas tree areas. A five year sale to the G. R. Kirk Company was made. Receipts of the sale were put into Nutterson-Vanderburg funds which were used for application of

stand improvement measures. A harvest cutting was made in 1942 and cultural practices were carried out. Unfortunately, the war made further compliance by the contractor impossible, and the project was abandoned. Similar projects were undoubtedly attempted elsewhere, but none have been carried through.

K. A. Anderson, Assistant State Forester, feeling that pruning might make each tree on the area a potential Christmas tree, pruned every living tree on a five acre plot northwest of Kallepall two years ago. Results of this study are not complete.

Present studies being made by A. L. Doe of Northern Rocky Mountain Forest and Range Experiment Station represent some of the first scientific work to be done on Christmas tree management in Western Montana. In October 1947, three permanent plots were set up on Thalia White's Christmas tree area near Dayton, Montana. Two plots were established in a typical pole type that date to determine the effects of thinning in such a stand. A third plot was designed as a test of stump culture. In addition to these plots, twenty-five paired trees were selected for a pruning experiment. Pruning of one of the pairs was done by random selection, the other being left unpruned as a check. Four methods of pruning were used. Definite results of this study will not be available for some years.

On December 10, 1948, at a meeting of the Supervisors of the eight Soil Conservation Districts of Western Montana the following

resolution was adopted:

"We recommend that the Western Montana Soil Conservation Districts encourage improved cultural practices on Christmas tree land, secure technical assistance in forest culture from cooperating agencies and encourage the development of a marketing system designed to improve the quality of trees produced through a grading system with preduster prices."

Action on this resolution was taken by the District Supervisors of the Flathead Soil Conservation District in March of 1947. A committee of four with John P. Drummond, Extension Forester, as chairman was selected to investigate the feasibility of Christmas tree grading. In June of 1947 a sub-committee of six men, with A. L. Roe of the Northern Rocky Mountain Experiment Station as chairman, were selected to formulate grading specifications. To date preliminary grading rules have been devised, and will probably be submitted to the steering committee in the near future.

In the fall of 1947, a group of approximately twenty growers near Dayton, Montana, formed what is believed to be the first association for the promotion of Christmas tree management in Western Montana. Known as the "Rocky Mountain Fir Development Organization", its purpose is to promote better cutting and cultural practices in Christmas tree industry, and develop markets for other woodlot products. Thain White of Dayton, Montana is president of the organization. Correspondence should be addressed to Mrs. Essie Martl, Secretary, Dayton, Montana.

CHAPTER II

PRODUCTION METHODS

Operations involved in Christmas tree production may be broken into two component parts; woods practices and yard practices. Woods practices include cutting, yarding, skidding, and sorting operations. All of these operations are carried on in the woods at or near the scene of cutting.

Woods Practices

Cutting

Cutting Season

The average cutting season is about five weeks in length. Cutting usually begins about October tenth and ends about November twenty-fifth. A long season is usually required for the larger operators to concentrate their crop and meet production and shipping schedules. With increasing production handled annually by these larger producers, there has been a strong tendency to lengthen the cutting season, in some cases beyond a safe period.

There is a limit to how early trees may be cut and retain their needles. If trees are to remain marketable under present methods of storage and shipment, they should not be cut until they are dormant. During the last decade, weather conditions have permitted safe cutting

after about October tenth on the average.

Unfortunately weather is variable and often does not conform with production schedules and shipping deadlines. The war years and post war years have produced transportation difficulties requiring earlier or shipping. If anticipated production requires a six weeks' cutting season, then early shipping deadlines may dictate a cutting date so early as to result in serious loss of trees suitable for the market.

Such a condition prevailed in the industry in 1947. Warm rains delayed dormancy in many areas until the middle of October. Cutting began earlier in these areas and was a major cause of premature shedding of needles in the concentration yards. Loss was most pronounced in the Wisconsin area where some cutting was done as early as the twenty-second of September. No quantitative estimate of the loss is possible but one large shipper in Wisconsin anticipated a loss of 15 per cent as a result of early cutting.

Producers usually delay cutting until what they call a "killing frost" has occurred. These frosts "set the needles" and it is then safe to cut the trees. Such a frost occurred this year in the latter part of September, but it apparently was not heavy enough to sustain dormancy. Thus, frosts, unless hard and re-occurring, are often a poor indicator of a safe date to begin cutting.

A rule of thumb, used by one operator in determining when to

begin cutting, is to never cut a tree until the deciduous trees have begun to lose their leaves. Actually, this is a more sound indication of dormancy than occurrence of frosts, since formation of the abscission layer on deciduous trees definitely indicates dormancy.

Who cuts Christmas trees?

Christmas tree cutters fall into three classes, the owner, the cutter hired by the owner, and the professional cutter hired by the large Christmas tree companies.

When the owner, or man hired by him, cut an area for Christmas trees, better cutting is the usual result. Culls are kept to a minimum and the stumpage is cut with an eye to future yields. Professional cutters, skilled in judging trees which are "marketable" usually cut an area harder than is commensurate with continuous production. For this reason, owners often avoid hiring this type of cutter unless they can give close supervision to the cutting as it progresses. Of the twenty-seven operators studied in detail, cutting was done as shown in Table I.

Of the fifteen who hire cutting done, six give personal training by demonstrating how the cutting is to be done. Of the remaining nine, six merely specify how stumps are to be treated, and how slash is to be taken care of. The remaining three rely on the cutters' experience, and give no instruction whatsoever.

TABLE I

CUTTING PRACTICES OF TWENTY-SEVEN CHRISTMAS TREE GROWERS

Cutting done by	Number of growers	Per cent of total
Owner only	6	22
Owner and relatives -- share basis	6	22
Owner and cutters trained by owner	13	48
Professional cutters	2	8
Total	27	100

What makes a good cutter?

That some men can never learn to cut Christmas trees is an often heard remark among Christmas tree operators. Most operators agree that it is easier to teach young men to cut trees than older men. They say that a young man can visualize a marketable tree even when there is no apparent break in the crown.

Many private owners state that when cutting on their own land, they prefer to hire inexperienced cutters and train them to their way of cutting. If on the other hand, they are cutting on state or government stumpage where production rather than management is the aim, professional cutters are preferred.

One cutter, capable of cutting 300 to 400 trees per day for the companies, told the writer it took him half a day to cut one tree, the tree his wife would allow in her house. The acid test of what makes a good cutter is not ability to cut only very high grade trees -- anyone can do that -- but ability to cut rapidly, trees which will meet minimum market specifications.

How are trees cut?

Only two of the owners visited cut Christmas trees with a saw, others preferring to use a double bitted axe. All but one owner uses the two and a half pound cruiser's axe with a twenty-eight inch handle.

This preference for the axe lies in its speed and better

adaptability for pruning and limbing of long-butts. Proponents of the saw admit the superior versatility of the axe, but argue that the saw causes less wounding. Thus, wounding is less on stumps left for culture and recovery quicker. Greater safety in thickets is another reason for use of the saw. For those who intend to carry on intensive management, use of the saw may be the best way to cut.

Cutting with the axe requires skill to prevent splitting of the stump. This splitting usually occurs when the tree is cut in two blows. The sidewise action of the axe in removing the tree from its stump usually splits the stump from an inch to three inches. This splitting will cause drying of the cut portion, and if the top limb intended for culture is above the bottom of the split, it will usually die.

There are four steps in cutting which usually include yarding and slash disposal as done by most cutters. First, the tree is cut. Second, it is trimmed to an even whorl, or cut at a point where it will make a Christmas tree. Third, it is yarded to a point where it can be picked up for skidding. Fourth, brush is trimmed or knocked down on the ground according to the owner's direction. Not all operators lop and scatter the brush, but all agree that trees long butted should be free of their stumps and no hang-ups left to hinder cutting the next time the area is harvested.

Expert cutters, relieved of all other responsibility than cutting, can cut up to 500 trees per day in good stumpage. Unless stumpage is

exceptional, when the cutter yards and trims up brush, production usually falls below 300 trees per day. Most cutters can cut from 150 to 200 trees per day in average stumpage.

How are cutters paid?

Experienced cutters prefer to be paid on the piece basis. Averaging four trees to the bale, piece cutters were paid thirty-five to fifty cents per bale in the 1947 season.

Most growers prefer to hire cutters on an hourly basis. A prominent reason for this method of hiring is that cutters will follow instructions more carefully and better cutting and slash disposal is the usual result. Wages ranged from \$1.00 to \$1.50 per hour in the 1947 season.

Those growers who hired no cutters were certain they made more by doing all of their own cutting. No supervision of cutting was necessary and cutting was done as best they knew how. One such grower claims returns as high as \$75.00 per day. Average returns for their own cutting of \$25.00 to \$35.00 per day probably represent a model figure.

Cutting Regulations

Small owners and growers do not have written cutting regulations for hired cutters to follow. Such regulation as is given, is usually de-limited by personal instruction. The amount of instruction given depends on the owner and is based on how carefully the owner himself cuts the land. The owner usually specifies how the trees are to be cut,

whether stumps are to be left for culture or killed, and what extent of slash disposal is desired.

The Forest Service and the state, however, have written regulations for cutting to which the cutter must adhere. Administration of such control is difficult and violations of the regulations are usually handled by not awarding stumpage allotments to the violator the next season. In recent years, similar regulations have been adopted by the large private owners who sell stumpage.

The cutting regulations of the Forest Service are made a part of the sales agreement. Of the sixteen clauses, six of them pertain directly to cutting as follows:

1. No trees will cut until paid for
2. Trees will be piled or baled for count.
3. Slash will be disposed of as instructed by Forest officers (now require lopping and scattering of all slash).
4. All tree stubs shall be cut not over sixteen inches from the ground. The stump and long butt shall be trimmed of all branches at the time the trees are cut.
5. No tree shall be cut which is more than eight feet from the nearest coniferous tree of any size.
6. No tree more than twenty feet in height shall be cut unless specifically designated by the forest officer and no tree over four inches in diameter four and one-half feet from the ground shall be cut unless 50 per cent of the total length is utilized as a Christmas tree.

A complete copy of the regulations may be found in the Appendix.

Yarding

Yarding defined

After a tree is cut, the cutter trims the butt to an even whorl of branches, or to a point where the tree will make a Christmas tree. The tree is then dragged or carried to a skid trail, and laid butt first for removal to the yard. This phase of production is known as "yarding".

Who yards the trees?

Cutters usually yard their own trees. Exceptions may be where an owner has hired a cutter on the hourly basis, or where a cutter working on a piece basis is hired with the understanding that his sole job is that of cutting. In either exception men or boys are hired as yarders and usually paid on an hourly scale. The 1947 wages for this job seldom exceeded \$1.00 per hour. Of the twenty-seven growers contacted only two hired men to yard. Two growers cut the trees, and their wives yard them.

How is yarding done?

Dragging of trees during yarding is a universal mal-practice. Trees should be carried, whenever possible, to points of removal. A light blanket of fresh snow is the one exception to this rule. If trees are dragged on even the lightest crust, damage is certain.

Maximum yarding distances

An adequate network of skid roads, or truck roads will obviate

the necessity of dragging trees. Such an access system should require a maximum of 150 foot yarding distance. Seven of the areas observed met this standard of accessibility, but only one operator required that the trees be carried.

Skidding

Skidding defined

"Skidding" is the term applied to the method of moving the trees from yarding points to the Christmas tree yard. Some areas entirely accessible by truck roads eliminate this phase of production by hauling the trees loose directly from the yarding points to the Christmas tree yards.

Methods of skidding

Methods of skidding vary with the owner's financial means. Where owners keep teams for farm work, they are easily adapted to skidding with a go-devil or stone boat.

Six of the owners employ wheel tractors with go-devils or trailers for skidding. Markun of Kalispell has a converted jeep-like model-A Ford which he uses with a two wheel trailer. Chris West of Darby is unique in that he is probably the only operator in Montana who skids with a horse or caterpillar tractor equipped with an Indian travois. Loads with this rig average 100 trees with the horse, and 300 to 500 with the tractor.

An argument against the stone boat or go-devil for skidding, voiced by one operator, is that its small clearance in rough ground results in

many broken tops as it rides up and over obstacles. A solution to this problem would be to mount a bar or rack about two feet above the end of the boat and stack the trees lengthwise, thus raising the tops about three to four feet above the ground. Crosswise stacking of small trees on the go-devil with tips in and butts out will eliminate this type of damage without the addition of a rack.

Choice of skidding equipment

Choice of skidding equipment should be governed by the overall accessibility of the Christmas tree area. If the land was purchased as out-over land, the skidding trails used during logging can usually be developed with a minimum of expense into acceptable truck roads. Skidding distances under such circumstances are usually considerably less than one-quarter of a mile. Areas logged by horse and railroad usually do not have the accessibility resulting from caterpillar logging, and considerable investment may be necessary for adequate accessibility. Where skidding will generally exceed one-quarter of a mile and where truck roads are not established, a two wheel tractor with a rubber tired trailer is recommended as being the most economical and flexible method. Skidding may be eliminated entirely by direct hauling with a pick-up or truck.

On areas where skidding may be eliminated by direct pick-up by trucks, it is best to yard a truckload of trees to the point of loading or about 1,000 trees of average size.

Analysis of skidding methods

Skidding data gathered from the growers is given in Table II. The average skidding distance shown in the average distance for all owners using the same equipment. It will be noted that the cutting areas of eight of the growers are so small that skidding has been eliminated as a step in the production of trees.

Yarding

All of the growers of owners have their own concentration yards. Christmas tree yards are generally an opening in the woods, or may be convenient spots alongside the truck roads where trees are sorted to size and graded for sale. Two of the owners haul their trees from points in the woods to their farm yards where sorting and grading is done. Trees are segregated in piles by the following sizes.

2 foot size -- trees 1 $\frac{1}{2}$ to 2 $\frac{1}{2}$ feet in length
 4 foot size -- trees 3 to 5 feet in length
 6 foot size -- trees 5 to 7 feet in length
 8 foot size -- trees 7 to 9 feet in length
 10 foot size -- trees 9 to 11 feet in length

Grading by the owner is usually based on experience of past cutting.

Certain companies will accept a lighter tree than others; truckers like heavy trees, etc. Thus, grading is usually based on requirements of the buyer to which the owner expects to sell.

Yard Practices

Steps of production, grouped as yard practices include inspection

TABLE II

METHODS OF SKIDDING

Equipment and method used	Average skidding distance	Number of users
Team and go-devil	1/3 mile	5
Horse and go-devil	1/4	4
Two wheel tractor and go-devil	1-1/2	6
Converted model-A Ford and trailer	2	1
Tractor and wagon -- team and go-devil	1/4 -- team 1 -- tractor	1
Horse or caterpillar tractor and Indian travois	1/2 -- horse 1 -- tractor	1
Caterpillar tractor and go-devil	1-1/4	3
None	-	6

in the woods, hauling, re-sorting, tagging, tying or baling and loading for shipment. Although tying may be done in the woods it is still strictly a yard practice, the only difference being that tying is done in a small woods yard instead of a large concentration yard.

Inspection in the woods

After an owner has cut, yarded, skidded, sorted and graded his trees, he contacts prospective buyers and invites their inspection of his trees. The larger companies provide inspectors who come to the owner's woods yards and grade the trees before accepting them for hauling to the concentration yards. At this time a count is made of the acceptable trees. If all is satisfactory between grower and inspector, arrangements are made for hauling the trees to concentration or shipping yards.

Hauling

Hauling trees to the concentration yards is done by truck. In most cases the hauling cost is borne by the buyer. For those owners having trucks it may be profitable to haul their own trees. Hauling cost varies from seven to ten cents a bale if contracted.

Of those contacted, twelve of the owners did their own hauling. The shortest hauls were found in the Burke-Fortine area, seldom exceeding twelve miles. Longest hauls were found around in the Kallispell area, most of which exceeded twenty miles.

Analysis of hauling data for the twenty-seven owners contacted

show a minimum hauling distance of one mile, a maximum hauling distance of thirty-five miles, and the average hauling distance of all those contacted, of twelve miles.

Re-sorting

When the trees reach the buyer's yard, they are checked for ownership and number of trees in the load. They are then unloaded, and re-sorted for size and quality. All breakage occurring in hauling is discarded and the remaining trees are ready for tagging and tying.

Tagging

All trees purchased by the large companies are tagged before baling. Trees purchased by truckers are seldom tagged.

Tags bear the size class of the tree, the trade name of the species and the Christmas tree company under whose name the tree is sold. Tags usually are given a different color for each size class. This is an aid in loading cars for shipment. When unfolded, the heavy paper tags are about one by five inches in size. Tags are folded over the limb with the printing out, and the two ends are slipped or stapled together. Tags should be fastened around the sturdiest limb on the bottom whorl as close to the bole of the tree as possible.

Women are usually hired as taggers. In 1947, wages for tagging averaged \$1.00 per hour.

Tying or baling

Trees under eleven feet are seldom shipped as individual units. To avoid breakage, and save shipping space, trees are tied into bales by size class. The number of trees per bale in each size class, and the minimum desirable weight per bale is shown in Table III.

Tying is done by men and women. Bales are tied on saw horses. Each saw horse has a guide made from two pieces of 1" x 2" about a foot long and nailed vertically about three inches apart at the middle of the horse. The horses are placed the proper distance apart for the size class being tied, and the first tree is placed between the guides. The butt is placed in the guide nearest the baler and the tip is held by the far guide. If four foot trees are being tied, then five more trees of this class are placed on the horses in the same manner, i.e., all butts and tops together. As trees are placed on the horses, the butts are pulled through the guide until the bottom whorl is against the butt guide, assuring an even bale.

Next, the bale is tied securely with binder twine, working from the butt toward the tip end of the bale. Bales should be tied securely enough to allow handling by the baling twine.

After the bale is tied the butts are cut square with a handsaw to form what is called the "handle" of the tree. Handles are usually six inches long for all size classes up to six feet. For 8's, 10's, 12's, etc., the handle is six inches plus an inch for every foot over six feet.

TABLE III

STANDARD CHRISTMAS TREE BALE SIZES AND WEIGHTS

Actual tree length (feet)		Tree size or Height class	No. per bale	Average weight per bale desired (pounds)
Min.*	Max.			
2	3	2 or more	8	16
3	4 $\frac{1}{2}$	4	6	18
4 $\frac{1}{2}$	6 $\frac{1}{2}$	6	4	24
6 $\frac{1}{2}$	8 $\frac{1}{2}$	8	3	36
8 $\frac{1}{2}$	10	10	2	60
10	12	12	1	35
14	-	14	1	40
16	-	16	1	75
18	-	18	1	125
20	-	20	1	200

* Every tree in the bale shall measure the minimum height, but none shall measure over the maximum height class of that bale.

i.e., eight inches for the eight foot class, ten inches for the ten foot class, etc..

Good balers tie with the idea of getting a heavy, good looking bale. The heaviest trees are always put on the outside of the bale. A heavy bale is considered an index to individual tree quality when purchased.

Shippers and concentrators paid five to seven cents per bale for tying during the 1947 season. At this rate, one woman observed in the A. J. Thomas yard in Eureka, Montana, averaged \$2.00 per hour for an eight hour day. Average wages for less expert balers were about \$8.00 to \$10.00 per day.

Loading for shipment

Baled trees are again loaded on trucks and transported to the railhead for loading on the railroad cars. Cars are usually loaded with regard to their destination. Every effort is made to keep the car weight up since purchasers often use car weight as an index of the quality of the trees in the car. The heaviest cars, with the least number of bales to the car, bring premium prices.

CHAPTER III

MARKETING METHODS

Buying Practices

Production statistics for 1947 as given by the Northern Rocky Mountain Experiment Station show that approximately 85 per cent of the total production was handled by the large Christmas tree companies. There are nine such companies operating in Western Montana at the present time.² These companies get most of their production from private and public lands adjacent to the shipping centers of Eureka, Libby, Kalispell, Plains, Polson, Missoula, Drummond, and Darby.

Some of the companies own land in Western Montana, and rely on its production to balance out shipping orders for shortages of certain size class. Most of these companies hire field men on a twelve or six months basis, who line up sources of production for the coming season. These men are usually residents of a community centered in the district in which they operate.

If sources of production fall short of advance orders, most of the larger companies rely on their field men to locate Forest Service and state stumpage to fill out their production needs. When such stumpage has been secured, professional cutters are hired, and this production is added to the harvest purchased from private owners, for shipment.

² See Appendix for list of Christmas tree companies

Most of the remaining production is purchased by independent truckers. These truckers come in year after year, buy a truckload of trees and haul them to some town or city in which they expect the market to be short. As a general rule, truckers require a better grade of tree than the large companies. As would be expected, truckers usually pay half again as much per bale as the companies, since their success lies in the quality of the trees purchased rather than the quantity.

Probably not more than 1 per cent of the production is retailed directly by the growers themselves. Some growers retail a truckload or two each year, but lack of contacts, little knowledge of market conditions, and other responsibilities usually discourage most growers from attempting to regularly retail their own trees.

Table IV shows who purchased the trees of the twenty-seven growers contacted and how many retailed their own. It is intended to illustrate the approximate distribution of buying between companies, truckers and direct retailing by owners.

Selling Practices

There are six ways in which growers and owners sell their trees to the companies and truckers: 1) loose in the woods; 2) baled in the woods; 3) delivered loose to the buyers yard; 4) delivered baled to buyers yard; 5) sale of stumpage; and 6) the hump run sale. A few growers prefer to retail their trees themselves and have established their own market which they supply every year.

TABLE IV

SALES OF TWENTY-SEVEN GROWERS -- 1947

Buyer	Number of growers	Average price per bale (loose in woods)	Distribution of buyers (per cent)
Company or shipper	19	\$1.05	70
Truckers	3	1.47*	11
Company and truckers	3	-	11
Company and direct retail	1	-	4
Company -- trucker -- retail	1	-	4
Total	27		100

* Estimated

A representative picture of the selling methods used is shown in Table V. Note the combinations used by some of the growers. A discussion of these selling methods follows:

Loose in the woods

Sale of trees unbaled in the woods yard is termed "loose in the woods". The owner contacts a buyer when the trees are ready for inspection, and if they are acceptable to the buyer, sells them as they lie. This is a good way for a grower to sell his trees. Any breakage occurring during loading, hauling and unloading is not a loss to the grower, but is taken by the buyer. H. Marken of Bigfork estimates such breakage to have been as high as 7 per cent at times, and will sell his trees by no other method. Aside from avoiding loss, the owner does not have to own a truck suitable for hauling trees, or hire truckers for hauling.

Baled in the woods

Many trees are sold baled in the woods. Most sales to truckers are made in this way. The larger companies prefer to use their own balers. If the hauling distance is long, or if they have no yard near a railroad, they may send their own balers into the owners' woods yards to bale the trees. In this way, they can haul directly to the shipping point.

Owners selling to the large companies seldom bale their own trees. They feel that the extra money for baled trees is too little to bother

TABLE V

SELLING METHODS BY TWENTY-SEVEN GROWERS IN WESTERN MONTANA -- 1947

Method of selling	No. of growers using method	Per cent of total growers
Loose in woods	14	52
Baled in woods	2	7
Delivered loose to buyer's yard	2	7
Delivered baled to buyer's yard	4	15
Delivered on railroad car	2	7
Delivered on railroad car and sold stumpage	1	4
Direct retail and loose in woods	1	4
Direct retail and delivered loose to buyer	1	4
Total	27	100

with the Trucker, however, are seldom equipped to tie, and hence buy all their trees baled. Prices for baled trucker trees are usually half again as much as that offered by the large companies, and growers can well afford to bale their own trees for this type of buyer.

Delivered loose to the buyer's yard

This method of selling trees is little different than selling looms in the woods. The grower merely goes one step further and delivers his own trees. Selling prices should be about ten cents higher per bale if the hauling distance is not excessive. Sometimes a grower sells his looms in the woods, and then charges the buyer ten cents per bale for delivery to the shipping yard.

Delivered baled to the buyer's yard

Some owners prefer to bale and deliver their own trees. If trees are sold to a large company by this method, the trees are usually inspected by a company inspector before any baling is done. The owner should receive the regular baling and hauling cost to the company.

Selling Stumps

Whenever possible this type of sale should be avoided. Selling trees at so much a tree or so much a bale, with little or no control of cutting practices, may prove disastrous to the private owner.

However supervision is possible, and cutting regulations may be enforced this method is satisfactory when no personnel are available to

do the cutting. The Forest Service and the State, and some large private owners make all of their Christmas tree sales on a stumpage basis. It is the best method for such agencies. But, for the private owner incapable of cutting himself, hiring trained cutters is a better alternative.

Lump sum sales

Nothing good can be said of the lump sum sale. It has all the disadvantages, and none of the advantages of the other methods of selling Christmas trees. To sell all of the trees on an area for a set sum of money, is to invite slashing in place of cutting. Such a sale almost insures systematic gutting of the area. Not only is the owner cheated of his rightful return from the land, but the land is usually cut in such a manner that it will require years to produce another crop.

Retail sale by owner

Some growers, sell their volume of trees to the companies, and save a few of their best trees for retail sale. Those who have become established and return to the same stand year after year find a handsome profit for their extra time and work. For most growers, however, the story is different. With no prior contacts before arrival in a town or city, chances of selling their trees at a good profit are 100 to 1 against them. Should the town be one in which most of the trees are shipped on consignment, marketing of their trees is next to impossible.

Use of a contract in selling

Several of the large shipping companies use a written contract in purchasing trees. These contracts, according to growers interviewed, are of no protection to the grower or the company. Their function in past years has been more of a memorandum than a contract, and merely allows the companies to obtain a fairly accurate estimate of how many trees are available and from whom they may be purchased.

Only one grower, of those contacted, requires the purchasing company to sign a contract which is legally binding. This agreement stipulates the number of trees to be supplied, that all trees supplied shall be taken, and provides that the owner may be relieved of his production commitments if weather conditions make further cutting impossible.

All growers and producers should require written sales agreement. If such agreements were required many trees would not be left in the woods. Past buying practices of some of the companies have been a source of waste and ill-feeling merely because there was no binding agreement between the buyer and seller.

One practice which produces an unhealthy condition in the industry is excessive culling of trees in the woods. This usually occurs at the end of the season when production is almost complete. Some size quotas are filled, and so to avoid over production the inspectors are told to cull heavily. In some cases trees are never inspected, and left for the owner to dispose of them as best he can. The better companies

will buy such trees rather than cause ill-feeling, but there are too many shippers who will not. As long as a binding sales agreement is lacking, the owner will never have a way to combat this type of business practice.

CHAPTER IV

TYPE OF LAND SUITABLE FOR CHRISTMAS TREE PRODUCTION

Before attempting to identify what constitutes good Christmas tree land, it will be helpful to first consider sources of Christmas trees, and what it is that makes a Christmas tree.

Sources of Christmas Trees

Christmas trees come from three sources. First are "topper trees" which, as the name implies, are cut from the tops of trees three to six inches in diameter at breast height. Toppers usually occur in pole-type thickets, and are cut from the tops of the dominants in the thicket. As little as one-quarter of the entire tree may be utilized although on the average, at least one-half of the entire tree is utilized as a Christmas tree. Second, are "ground trees" which are trees cut at regular stump height, and with few exceptions utilized entirely. The third source are the "burn-ups", "limb trees" or "stump trees". Such trees are produced when green limbs, left on the stump from which a ground tree was cut, turn up and become the main stem of the tree. Regardless of the tree's source, all trees must meet certain quality requirements to be acceptable for Christmas tree use.

What makes a good Christmas tree?

A desirable Christmas tree must have good color, heavy foliage, a dense compact crown, and a symmetrical form. Color of the tree should

be a healthy dark forest green. Foliage density is best when all branchlets and branches are covered with needle growth right up to the stem of the tree. To be of highest quality the tree should be perfectly symmetrical. To get these requisites of quality requires a certain combination of growing conditions. Good Christmas tree land is obviously land on which a desirable combination of these growing conditions exists.

Good color results from open, vigorous growth. If the trees are heavily shaded, the foliage is apt to be a lighter green than is desirable. Best color is usually found in open-grown trees, topplers usually excelling.

Dense foliage and greater needle length is usually produced on areas in which moisture and light are adequate for vigorous growth.

A compact dense crown is produced by a combination of good vigor but not too rapid growth in relation to total height and needle coverage. The yearly height growth determines the distance between the whorls on the stem. On trees up to six feet in height the distance between whorls should not be more than six to eight inches. Presence of intermediate branchlets and heavy needle coverage will compensate to some extent for greater distance between whorls. On more moist sites, toppler trees usually excel in desirable crown density since they have usually slowed down in height growth and maintain a uniform whorl distance.

Symmetry is governed by whorl arrangement and equal branch length in any one whorl. To have four sides complete there should be at least

four branches evenly distributed about each whorl. When any one whorl has less than four branches the tree will usually have a "hole" in it, and makes a three sided tree. Incomplete whorls at the bottom of the tree destroy a symmetrical appearance more than any place else in the tree. Equal branch length in the branches of any one whorl is only possible when the tree has light from all sides. Shading or crowding will always produce a lop-sided low quality tree, if marketable at all.

Where Do the Best Trees Grow?

Producing areas of Eureka and Fortine in Lincoln County and Somers and Dayton in Lake County, lie within the natural range of the Larch-Douglas fir type. In these areas, it was observed that growth conditions are such that the best Christmas trees are found on the intermediate to poorer sites. Ridges, flats, benches, and on the slopes the south and west aspects produce the heaviest, best formed trees. On the northern aspects height growth is generally too rapid for production of quality Christmas trees.

In the Libby, Kalispell-Sigfork, and Plains-Thompson Falls areas of Lincoln, Flathead, and Sanders Counties, respectively, the best producing lands are in the Ponderosa pine type in which fir is not found as an associated species until the type leaves the valley floor. Douglas fir admixtures consequently occur on the lower slopes and ridges. Apparently in these areas, moisture conditions are such that quality growth may be found on all but the most northern exposures.

In Missoula and Ravalli Counties, moisture and growth conditions

are such that fir occurs only on the most northerly aspects and in deep protected draws. This situation is very pronounced in Nevada County near Darby.

Criteria of Lands Suitable for Christmas Trees

Generally speaking, cut over land, well stocked with advanced fir reproduction prior to logging, and reproducing naturally to fir after logging makes the best possible Christmas tree land.

Certain portions of these lands are more suitable for Christmas tree production than others. In an attempt to identify criteria for choosing Christmas tree land, data on slope, aspect, soil, overstory, reproduction, and fir and logging history were gathered on twenty privately owned areas now producing trees for Christmas tree use.

Analysis of this data has indicated that criteria for Christmas tree lands fall into two natural groups, 1) growing conditions as indicated by aspect and soil and 2) observable physical condition of the area as a result of overstory, reproduction, logging history and accessibility. In these two groups combined, there are six factors useful as indicators of land suitable for the production of marketable Christmas trees.

1. Aspect. Within a particular locality, quality trees are mostly found only on certain aspects. In the natural range of the Larch-Douglas fir type, the best trees were observed on ridges, flats, and

hances and southeast slopes. These areas are the intermediate to poor sites for timber production where moisture conditions prevent height growth from being too rapid for good crown density.

In producing areas within the northern limits of the ponderosa pine type, namely the Libby, Kalispell, and Bigfork areas, aspect was not a factor in quality of trees except on the most northerly exposures. With less moisture available to all exposures only the *due north* aspects presented undesirable height growth for quality trees.

Aspect again assumes importance in the southern limits of production. Areas adjacent to Darby, are in the drier sites, the better sites for ponderosa pine, and fir occurs only on the northern slopes and in deep protected draws.

Aspect is important mainly as an indicator of desirable moisture conditions. Within a locality, aspect is a valuable aid in the evaluation of land suitable for Christmas tree production.

2. Soil. The type of soil on an area is the most reliable criterion of Christmas tree potential. Shallow clay-loam or sandy-loam underlain with rock or gravel is the best soil for quality Christmas trees.

Any area, regardless of aspect, moisture, or timber type, will be unsuitable for Christmas trees if the soil is deep and well drained. Soil conditions found on good to best sites will give too rapid a rate of

height growth. On the intermediate to poor sites, the soil is shallow and often poorly drained. Growth though vigorous will not be too rapid and the density of the crowns will be better because of these site conditions.

On the twenty areas observed, the top soil was largely clay-loam, sandy-loam, or gravelly clay. Most areas were underlaid with rock or gravel and clay. The best rate of height growth in relation to total height was observed on a thinly covered gravel bar adjacent to the Kootenai River. Areas in Bigfork, Somers, and Dayton were underlaid with rock, with many outcroppings near the ridges. Quality trees were produced on these areas.

As a criterion of good Christmas tree lands, soil is the most important. Unless the proper type of soil is present, quality growth under present management practices will be impossible.

3. Overstory. The extent and amount of overstory are indicators of whether land is currently capable of Christmas tree production. Keeping an area in sustained production of Christmas trees involves techniques which literally force the area to remain in a state of "arrested development". Control of the overstory must be maintained. Thus the amount of overstory on an area at the time of prospective purchase is a criterion of the land's suitability for Christmas tree use.

If the area is of virgin timber growth, one cutting for Christmas trees may be made, possibly two. But unless overstory is reduced, natural

reseedling and subsequent reproduction will probably not be adequate for sustained production. Quality Christmas tree growth requires light from all sides and above, and adequate growing space for each tree. A light overstory on the other hand is essential for protection of the young stand and necessary as a source of seed.

Most of the areas studied were cut mainly for pines about fifteen to twenty years ago. Only the best fir and larch were removed at that time. Today, the overstory on these areas average twenty to thirty-five trees from three to six inches in diameter at breast height and over, most of which are Douglas fir. All operators contend that for continuous and quality growth this overstory should be reduced to ten or fifteen well distributed trees per acre, of which six to ten should be seed producing fir trees.

Removal of this overstory is a direct expenditure of time and money for most operators. Unless markets are developed for this type of material, such as fence posts, ear stakes, corral poles, etc., few owners will indulge in such operations.

4. Reproduction. The advanced reproduction on an area is the growing stock of a Christmas tree operation. Without it there is little chance of continuous production. On all but three of the areas studied, reproduction was good to excellent. Condition of the reproduction was judged on the presence of seedlings up to four feet in height. This height limit was chosen because few ground trees less than four feet in height are cut for trees. Presence of trees up to four feet is an indi-

erator of growing stock. Causal factors on the three areas of poor advanced reproduction were heavy browsing by stock and poor regeneration due to stagnated stand conditions.

E. Logging history. The date and method of logging are important in indicating Christmas tree possibilities. The areas covered had been logged on an average of fifteen years. This span of time was adequate for establishment of regeneration following logging, and for the development of the advanced reproduction present prior to logging. On most areas logged for this length of time, reproduction ranged from one year old seedlings to saplings up to three inches diameter at breast height. This is the condition necessary for Christmas tree production. On areas such as these, sustained production is a possibility.

In earlier logging operations skidding was done by teams. Very little damage to reproduction occurred. To offset this advantage, however, skidding trails and roads were not used enough to establish permanent accessibility to the areas. Development of an adequate road system in an area logged by horses is usually more expensive than areas later logged by caterpillar tractors.

In later logging operations, skidding was mostly by caterpillar tractors and hauling by truck. Skidding by tractors usually damages advanced reproduction heavily, but on the other hand, scarification brought about by this skidding method provides a favorable seed bed for establishment of regeneration after logging. The main advantage in tractor and

truck logging, however, is not good bed preparation, but the accessibility offered by the system of skidding and truck roads established on the area during logging. Such roads can usually be developed into adequate Christmas tree roads at the minimum of expense.

8. Accessibility. Good Christmas tree land must be accessible. Quality trees are worthless if they cannot be marketed at the same cost as other trees. Not only should the area itself be accessible from the standpoint of harvest operations, but it must be accessible to marketing and shipping points. There are few areas in Western Montana inaccessible to markets, but many are inaccessible for harvesting operations. Good roads may become impassible overnight in periods of excessive rain or snow. If such an occurrence takes place at the wrong time, several days cutting may be lost and the trees necessarily left in the woods. Many lands capable of producing excellent trees have remained undeveloped because of the initial expense of road construction into the areas.

All of the areas studied were very accessible, and their accessibility was undoubtedly a major factor in their original purchase and development.

In summary, there are two main criteria for selecting lands for Christmas tree production, namely growing conditions and the physical condition of the area. The two main groups include six factors which have value as indicators in determining the suitability of lands for the production of Christmas trees. A resume' of these factors and

their essentials follows:

Growing conditions:

1. Aspect -- valuable as an indicator of moisture conditions. Should only be applied within localities.
2. Soil -- most reliable of criteria -- soil should be shallow clay-loam, sandy-loam, or gravelly clay and overlaid with rock or gravel.

Physical conditions

3. Overstory -- an indicator of adequate seed source, and possibilities of sustained production. Light overstory is desirable. Should be ten to fifteen per acre, six to ten of which should be seed producing fir. Reduction of overstory is usually necessary and must be considered a direct expenditure.
4. Reproduction -- presence of advance reproduction is essential to sustained production. Advanced reproduction is growing stock of operation. Should be present on the area at the time of purchase.
5. Logging history -- knowledge of logging history is a key to presence of adequate reproduction and overall accessibility of the area.
6. Accessibility -- accessibility of the area is most important consideration. Quality growth is valueless if trees cannot be marketed at a reasonable cost.

In conclusion, these factors while common to twenty representative growing areas, now in Christmas tree production, should not be considered positive criteria of Christmas tree lands. I have been on only the most accessible areas, developed since the industry's inception because of this accessibility. Other areas of higher elevation, and beyond

the present limits of the producing areas, may differ in certain respects and these indicators may well be away in now undeveloped areas. Careful observation of land prior to purchase is a first essential. If there are quality trees on an area and local conditions point to possibilities of sustained production, the fact that some of the criteria discussed are not not may be of little importance.

CHAPTER V

MANAGEMENT PRACTICES ON PRIVATE LANDS

Management practices for the production of Christmas trees as a crop, must be designed to produce trees of a form suitable for Christmas tree use. Trees most suitable for Christmas tree use are found between the sapling and pole stage in the development of the stand. If Christmas trees are to be produced on a sustained yield basis, then management techniques must be designed to hold the stand in a state of arrested development and as much of the area as possible kept in the sapling and younger pole stage.

At the present time, such techniques of management have been developed on private lands. Lack of personnel, and more interest in "saw-log forestry" than in other forest products on the part of public agencies has resulted in regulations for cutting of Christmas trees which serve only as a means of controlling poor forest practices from the standpoint of timber production.

Desirable management practices for Christmas tree production have been designed by technical foresters and progressive growers. Stan Larson and Ross Williams have been foremost in formulating practices, based on close observation of private lands in Christmas tree production throughout Western Montana. These practices, while desirable, have been only partially adopted by most private growers. One purpose of this survey was to determine which of these practices have been adopted and the

of the trees. The length of time elapsing between cuts on any one area varies from one to six years with the mode at three years. The object is not to regulate the number of trees cut each year, but rather to allow sufficient time for the trees remaining on the area harvested, to develop into merchantable Christmas trees.

The acreage owned in Christmas tree land is usually of most influence in the choice of a cutting cycle. Figured on a basis of forty acres per man, per cutting season, those owning 160 acres and cutting alone, usually cut on the same area once in four years.

Some operators make no attempt to regulate harvesting, cutting whenever the area is ready. Most operators agree that an area should not be cut more often than every other year.

Cultural operations

Pruning and stump culture are the main cultural operations practiced on private lands. Thinning and weeding of undesirable species, if done at all, is usually carried on during the harvest cutting.

Pruning

Trees are pruned with the idea of improving crown density and symmetry. Advocates say that pruning trees to an even whorl will cause the remaining portion of the crown to slow in growth, and therefore thicken the crown making it suitable for Christmas tree use. On areas where growth conditions are such that whorl distance is excessive, it is

claimed that severe pruning will stimulate adventitious growth on the stem and intermediate branchlets. This increase of foliage makes the tree appear thicker and to have better crown density.

Some growers advocate pruning of one sided trees, or trees having un-symmetrical crowns. These growers claim that non-symmetrical trees can be helped by pruning and "scarring" or "scabbing" of the tree. This additional operation consists of blasing the tree heavily on the bole near the ground. Scarring is preferably done on the side on which growth is heaviest, thus allowing the light side to fill out and form a symmetrical crown.

Of the twenty-seven growers contacted, nineteen indulge in pruning, only two of these nineteen limiting their cultural practices to pruning. Table VI lists the various methods of pruning used, the number of growers which prune during or after harvest and the total number of growers using each pruning method.

It should be noted that eighteen or 95 per cent of those who prune, carry on the operation during the harvest cutting. This is significant since reasons given for not carrying on cultural operations are generally based on the grower's contention that he cannot afford to do anything except cut trees during the harvest season, and that he has no time to carry on management practices after the harvest season.

That pruning is a worthwhile management practice is a matter of conjecture among foresters and some owners. One owner contacted felt

TABLE VI

METHODS OF PRUNING USED BY NINETEEN CHRISTMAS TREE GROWERS

Pruning method or how pruning is done	When pruning is done		Total number of growers using each method
	During harvest	After harvest	
Prune clean -- from even whorl to ground -- all trees	7	0	7
Prune clean -- from even whorl to ground -- in thickets and slumps only	1	0	1
Prune clean -- from even whorl to ground -- imperfect crowns only	1	0	1
Prune clean -- from even whorl to ground -- light and uniform crowns only	1	0	1
Prune clean and scar or seal -- from even whorl to ground on heavy side	3	0	3
Leave branches for stump culture and prune out remaining portion of crown to an even whorl	5	1	6
Totals	18	1	19

that pruning was a waste of time. He pruned some 5,000 trees on his area near Eureka about 1940 and says that the trees have still not recovered from the shock. H. Marken of Bigfork, on the other hand, says he cannot afford not to prune. He feels that rapid growth conditions present on his area makes pruning mandatory for production of trees suitable for Christmas tree use. This grower intends to invest his own labor in pruning during the winter and has set a goal of 52,000 pruned trees in 1948. Labor for pruning if paid in cash, would amount to \$2,000 or an investment of \$5.00 per acre for pruning.

The time required for a pruned tree to shape up into the desired Christmas tree form has been estimated from two to eight years. Many trees that were pruned would undoubtedly have been of good form without pruning, and it is these that naturally shape up first. Trees of light crown density and trees with non-symmetrical crowns must often grow practically new crowns and these trees probably require an average of five to eight years to become marketable Christmas trees.

The State supervised some pruning on their land near Bigfork, and northwest of Kalispell a few years ago in an effort to determine the value of pruning as a management practice. No results of this study are available. Several operators offered a premium of three cents per tree for stumpage on this pruned land. Pruning increases accessibility for cutting and makes cutting of ground trees easier and faster.

Stump culture

One of the most interesting and worthwhile cultural practices is pollarding. Pollarding or stump culture, as it is commonly called, is the culture of limbs that have turned up to assume the place of the main stem after it has been cut for a Christmas tree. When a ground-tree is cut for a Christmas tree, there are usually three to six limbs left on the stump. These limbs tend to turn up and one or more will assume the position of the main stem of the stump. If the stump is in the open all of the limbs will follow this tendency and unless trimmed down, will form a useless brush. If one limb is chosen, however, and freed of competition, it will turn up and produce four branches to the whorl. It is from this point that a new Christmas tree begins to form. This tendency to form a new tree from turn ups was noticed some years ago, and efforts were made to discover the best way to trim a stump for the quickest production of a tree. Many growers and cutters experimented with ideas ranging from leaving all of the limbs to leaving one or two and trimming back all the rest. Today, there are almost as many variations to stump culture as there are growers, but one main idea is clear -- it is a worthwhile management practice on Christmas tree areas.

Twenty of the twenty-seven growers contacted indulge in stump culture of one type or another (Table VII). The variation of method, when culture is done, and the number of growers using each method is shown in Table VII.

TABLE VII
METHODS OF STUMP CULTURE USED BY TWENTY CHRISTMAS TREE GROWERS

Method of stump culture	When done		Number of growers using each method
	During harvest	After harvest	
Cut tree -- return one year later and pick best leader on top whorl, trim away rest on that whorl, leave all other branches. After next tree is cut, repeat, working down the stump.	0	4	4
Cut tree -- leave one year, return and pick best two or three branches and trim away rest.	0	2	2
Cut tree -- leave two years, return and pick best two or three branches and trim away rest.	0	1	1
Cut tree -- leave one year, return and pick two branches, one on north and one on south side of tree. North branch will develop first.	0	1	1
Cut tree -- trim away all branches but one on top whorl, leave rest until time is out.	1	0	1
Cut tree -- leave three or four best branches and trim away all the rest.	4	0	4
Cut tree -- leave two limbs on opposite sides of base and a feeder limb below, trim away rest.	2	0	2
Cut tree -- leave two or three best branches and trim away all rest.	3	0	3
Cut tree -- leave three or four branches in two rows down the stump away from competition. Kill all buds in the bark on the limbless sides by scabbing or blazing heavily.	1	0	1
Slash through a whorl when cutting tree. Leave one branch on that whorl. Return in two years and leave at least five branches, scrub.	0	1	1
Totals	11	9	20

From Table VII it can be seen that eleven of the twenty, or 55 per cent of the growers trim stumps for culture during the harvest cutting. The rest advocate returning to the area for stump culture at a later date. Few of the growers contacted do any work in their Christmas tree areas at any other time than the harvest season. If trimming of stumps is not done at the time of cutting trees, many stumps are probably misced when the grower returns to the particular area. Allowing the stump to become accustomed to less leaf surface for the support of the advanced root system for at least a year before further reduction of the leave surface by trimming, is undoubtedly the best practice. But, unless an operator spends two or three weeks in the area for the express purpose of trimming up stumps, culturing at the time of cutting is probably the best method to follow.

Many growers claim that reduction of the leaf surface to that of three or four branches at the time of cutting will kill the stump. Areas visited on which this method of culture was practiced did not bear out this claim. Stump mortality on open areas was surprisingly low. A mortality of 10 per cent would be a high estimate. One reason for this perhaps, is the amount of adventitious growth which appears once the stump has been heavily trimmed. It seems almost impossible to kill an open-grown stump if some of the leaf surface is left intact.

The length of time required to produce a tree from a limb, and the number of trees that it is possible to produce from a stump are unknown figures. Some growers have cut a four foot tree from a stump

in two years. An average figure for development would appear to be about six years for a six foot tree. On areas around Somers and Dayton adventitious growth from buds in the bark of the stump will often produce a tree before a turn-up limb. Thain White estimates that 60 per cent of his stump trees result from adventitious growth, and that the limbs merely sustain the life of the stump during their development. As for the number of trees which can be cut from the same stump, this figure varies greatly with the age, exposure, moisture, vigor and general growing conditions for any particular stump. One stump observed showed evidence of eight cuttings for Christmas trees. Another observed was six inches in diameter and supported three perfect six foot trees.

Definite information capable of scientific replication is needed on the art of pollarding. It is the one management practice most operators are willing to carry on. It is the cheapest, least time consuming, and most promising cultural operation, that a grower can practice in producing trees on a sustained yield basis. More plots of the type established in 1947 by A. L. Lee on Thain White's ground are needed (page 7).

Thinning and weeding

Thinning is a practice which is not usually carried on as a separate operation. Done while cutting on a cut-to-see-cut-to-see basis, only two operators thin as a separate management practice. On most of the operations observed, the stands were in need of thinning. Constant strip-ping of the areas for Christmas trees will usually accomplish thinning to

a degree commensurate with the expense of the operation. Most operators will thin in clumps of growth while cutting and by pruning too, a sufficient vertical spacing is usually obtained so that competition for light is lessened.

Weeding is done much the same as thinning. When competing species are present and they are small enough for quick removal it is done while cutting. On a few areas competition from Ponderosa pine and larch was sufficient to cause a management problem to the operator, and in these cases, weeding was recognized as a direct expenditure if the stand was to be kept in continuous production of Christmas trees. Generally speaking, weeding in the areas observed could be best handled during the harvest cutting.

Slash Disposal

Slash disposal observed, ranged from none to complete logging and scattering of all brush. Over 50 per cent of the growers contacted contend that slash will disintegrate between the time the slash is created and the next cutting of the area, and make no attempt to handle the slash in any way. Three of the growers say that long-butts must be trampled down flat on the ground, otherwise no other slash measures are necessary. The remainder of the growers require complete logging and scattering of all brush resulting from cutting. These eleven operators agree that logging and scattering is necessary to make an area accessible during the subsequent harvest cuttings, and as a fire control measure. Observation

of an area lapped and scattered, and an area in which there is no slash disposal is argument enough for proper care of the slash.

The degree of management practiced by any one operator is dictated largely by the time available for such work. Eighteen of the growers related are farmers; two of the growers are seasonal employees of the Forest Service and have small farms in addition to their Christmas tree holdings. One of the growers is an owner of a sawmill and woodworking industry. Only six consider Christmas trees as their livelihood. All growers except those six then, have little time available for management practices in their areas except during the harvest season. If better management is to be carried on, the practices advocated must either be carried on during harvest season, or be worthy of the time necessary for carrying them out at other times of the year. It will be noted that present practices adopted as practical methods of sustaining production and increasing yields, have been those which can be carried on in the area during the harvest season.

Problems of Management

The problems of management as expressed by respondents of the twenty-seven growers contacted are listed as follows:

1. Disease and insects
2. Competition from undesirable species
3. Snow damage
4. Logging damage
5. Overthinning
6. Heavy browsing by cattle and/or deer
7. Road development
8. Utilization of long-butts remaining from topper trees

Ten of the growers expressed no problems of management. If at season end probably the most serious problems expressed were diseases and insects, browsing, and snow damage.

Diseases and or insects can damage and even destroy Christmas trees stands. A disease now important to Christmas tree stands of Eastern Montana is a fungus which attacks the Rocky Mountain Douglas fir. Known as needle blight, or needle eat of Douglas fir (Sheetselline pseudotsuga), most growers recognize and call this disease "blight".

"This disease attacks young trees primarily. First symptoms appear in the autumn or sometime early winter as yellow spots on the needles. By spring the spots change to reddish brown giving the larvae a mottled appearance. When severe, the disease kills all the needles except the youngest and the trees in mass appear to have been badly scorched. No feasible control measure for application in the Christmas tree stand has yet been developed."

Insects capable of seriously damaging stands are Cooley's gall louse, and spider mites. Cooley's gall louse (*Adelges Cooleyi*) is a spruce gall for which Douglas fir is the intermediate host. The life cycle is very complicated, and little is known of the actual damage that is done. On Douglas fir the insect is housed in little scabrous tufts on

3 Charles A. Kellner, and Art L. Bee, Management Practices for Christmas Tree Production, Northern Rocky Mountain Forest and Range Experiment Station, Station paper No. 9, November 1967, pp. 16 and 17 Statement in letter from Jesse L. Padwell, in charge, Portland Office, Division of Forest Pathology, Bureau of Plant Industry, Soils and Agril.-Entomol. Engineering, U. S. Department of Agriculture, as quoted in their report.

the under side of the needles. Damage seems to occur mostly in deformation of the needles, giving them a twisted appearance, and in some cases while not twisted, the needle has the appearance of a broken finger, which shoots off at an odd angle.

"The application of a miscible oil spray during the short period of time of the egg or early development stages has been recommended as giving satisfactory control. Feasibility of control in the Christmas tree stand remains to be determined."⁴

Spider mites may be another cause of defoliation but as yet little is known of their extent or seriousness. No control is as yet known.⁵

Heavy browsing of seedlings and limbs, especially those remaining for stump culture can cause extensive damage to Christmas trees stands. On one area the deer population was such that most of the lower limbs of all trees were browsed to a degree that made stump culture impossible. The same condition was noted on another area, the damage being attributed to cattle. Most damage by cattle is trampling of young seedlings. Damage to reproduction from trappings can be best prevented by fencing the area from livestock.

4 Charles A. Kellner, and Art L. Bee, Management Practices for Christmas Tree Production, Northern Rocky Mountain Forest and Range Experiment Station, Station paper No. 9, November 1947, p. 16 ... Statement in letter from James C. Svendsen, in Charge, Forest Insects Laboratory, Cour d'Alene, Idaho, Division of Forest Insects, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, as quoted in their report.

5 Ibid., p. 17

Weather conditions may cause heavy loss on some areas. Snow damage on one area observed actually devastated twenty acres, leaving nothing under four inches in diameter standing. Heavy snows may also prevent limbs left for stump culture from developing into suitable Christmas trees. Heavy thinning increases susceptibility to snow damage. For best protection from snow damage thinning should be light and often, thus allowing the stand to gradually adjust itself to the more open conditions.

Other conditions, although not expressed as problems of management, by the twenty-seven growers contacted, may damage or destroy Christmas tree stands. Those not yet mentioned are fire, hail, and unseasonal frosts.

Protection from fire will always be a problem of management. Christmas tree stands are especially susceptible to fire since they are essentially young growth and have very low resistance to fire. All operators pay fire protection required by state law. Fire protection is provided by the United States Forest Service or contracted to the Northern Montana Forestry Association or Blackfoot Forest Protective Association. Cost of the protection varies from two and one-half to three and one-third cents per acre in the present production areas. This protection has reduced fire damage to a minimum. But its danger should be kept foremost in the minds of growers and owners, even though such areas, on the average, are not considered particularly bad fuel types.

Hail can cause complete destruction of any particular harvest

drop. Unless such damage occurs, however, a few years of growth will usually bring the trees back to marketable condition. The same may be said of unseasoned frosts. They may kill back the new growth, but in a period of a few years recovery will be complete and the trees will again be marketable.

Yields Under Present Management Practices

The question of yields possible from typical Christmas tree lands under present management practices is difficult to answer in the number of trees per acre per year. For concrete keep accurate records of the number of trees cut, where they were cut, the average involved and how many times the area has been cut for trees.

In order to obtain yield figures which may be applied to any ownership it is first necessary to determine the effective acreage of the ownership. All of the acres on an ownership do not produce Christmas trees. Taxes and fire protection are paid on the entire ownership, on the gross acreage. If only certain acres produce Christmas trees, the yield of these acres must bear the expense of acres which are non-productive. For example, on forty acres of Christmas tree land which produce an average of 1,500 trees every four years, the gross yield is ten trees per acre per year, or 1,500 divided by forty acres times four years. Suppose these trees were produced from only twenty acres. The land then would be only 50 per cent effective, and the yield on the effective area would then be twenty trees per acre per year. The significance of effective acreage

is seen immediately if we compute the cost per acre of producing these trees. If each tree cost ten cents to produce the gross yield would indicate a cost of \$1.00 per acre, but because the area was only 50 per cent effective, the actual cost of producing the trees would be \$2.00 per acre. The significance of effective acreage can be seen immediately on areas which might be only 10 per cent effective.

By using the yield per acre per year on effective acreages accurate costs of production may be computed. Determination of the effective area of a Christmas tree area should be determined before purchase if possible in order to properly appraise the land's true productive capacity. Only one of the areas observed ran higher than 85 per cent effective, and the average for all twenty-seven areas was 68 per cent. In purchasing land which has not been under management for Christmas tree production, it is suggested that the effective area be assumed at 50 per cent until management practices have been carried on long enough to allow an accurate determination of this factor.

Only two of the twenty-seven growers contacted keep accurate yield records. Unfortunately the areas have such different locale, logging history, etc. that they cannot be used for any sort of a comparison. The data presented in Tables VIII and IX drawn from records of these two growers will serve as indicators of what yields are possible on Christmas tree areas when certain conditions are present. The yields are, I believe, good guide lines of the producing capacity of many lands in private ownership.

The first owner has a total of 680 acres in Carlstens tree land. Its location is near Fortline. The timber type is Larch-Douglas fir. The area was logged by horses between 1910 and 1915. There have been no fires on the area since logging. The land is fully stocked with Douglas fir. Some of the area has outgrown Christmas tree size. The owner cuts entirely with a saw. No cultural practices are carried on, yet he cuts limb trees in about eight years. Fencing is his weaktion and he has no time to work in the area except during the harvest season. He cuts his area once every three to seven years, with the average at about five years, "depending on regularity of growth as influenced by rainfall, slope, shade, and soil". Table VIII is a record of the yields from three different areas over a period of thirteen to sixteen years. The yields per acre per year are the highest recorded in comparison to approximate yields that were obtained from other growers.

The second owner "Y" has a total of 220 acres in Christmas tree land. Its location is near Somers. The timber type is Larch-Douglas fir. The area was logged by horses about 1930. There have been no fires on the area since logging. The land is medium stocked with Douglas fir and Larch. The owner cuts entirely with a two and one-half pound snagsaw axe. Both pruning and stump culture is practiced. All cutting is very carefully done by the owner. The owner spends approximately one full month at odd times during the year carrying on improvement practices of pruning, burning stumps for culture, thinning and weeding. The yields in Table IX are, I believe, lower than they would have been if management

TABLE VIII
 RECORDS OF OWNER "X" SHOWING
 YIELDS OF DIFFERENT AREAS WITHIN HIS OWNERSHIP

Data obtained	Area A	Area B	Area C	All Areas
Location of ownership	Fortine, Lincoln Counties, Montana			
Degree of management practiced	Careful cutting with saw. No cultural practices. Spends no time on area except during harvest cutting			
Ownership (acres)	320	160	200	680
Effective acreage	240	90	85	415
Per cent of effective area	75	56	23	61
Years cut*	16	14	18	"
Total number of trees cut	94,800	51,600	76,000	222,400
Yield per acre per year on total ownership	18	23	29	23
Yield per acre per year of effective acreage	25	41	68	38

* Total number of years area has been cut for trees -- not the number of times cut for trees.

had not been interrupted during the war years. One acre out, on both acres, would have probably been made, which would have shown yields approximately 55 per cent higher on a per acre per year basis.

Yield figures obtained from other growers were estimated both from the standpoint of the number of trees cut and the average from which they were cut. Yield per acre figures were computed from any yield suitable on approximately acres cut over. This figure was divided through by the number of years elapsing between cuts in the same area, to give the yield per acre per year. As such these figures represent the best possible estimate of yields under present management methods. The average yield for Gross ownership was computed at thirteen trees per acre per year. The average yield for the effected average was computed at twenty trees per acre per year. Though lower than yields computed from accurate records, the above figures, I believe, are conservative estimates of the average production which can be expected under present management practices on land similar to areas observed.

Desirable Management Practices

The main purpose of this study is not to recommend management practices for the production of Christmas trees, but to report those practices which are followed and the extent of their use. However, so that prospective growers may know of practices which are desirable and which may be actually necessary in placing an area under management, they are included in this report.

TABLE IX

RECORDS OF OWNER "Y" SHOWING
YIELDS OF DIFFERENT AREAS WITHIN HIS OWNERSHIP

Data obtained	Area	Area	All areas
	A	B	
Location of ownership	Cuts with axe Pruners, weeds, thins, stump cultures, spends approximately one month in area other than harvest season		
Ownership (acres)	70	120	190**
Effective acreage	50	110	160***
Per cent of effective area	71	62	76
Years cut*	6	6	-
Total number of trees cut	14,852	11,339	26,191
Yield per acre per year on total ownership	36	12	20
Yield per acre per year on effective acreage	50	18	33

* Total number of years area has been cut for trees, not the number of times cut for trees.

** Total area owned. 190A or total of area A and B is area on which records were kept.

*** Same as ** except on effective acreage.

Management practices which are desirable and recommended by foresters as means of increasing yields on Christmas tree areas are listed as follows:⁶

1. Reducing the overstory

If there is a heavy stand of immature overgrown trees occupying space which otherwise could be growing Christmas trees, their number should be reduced. In the majority of cases the trees removed will produce enough fuel woods, posts, poles, and sawlogs to more than pay for the operation.

2. Weeding

Most Christmas tree stands contain some undesirable reproduction of larch, lodgepole pine and birch. These trees should be weeded out as soon as possible or the cost of removal will become prohibitive.

3. Thinning

Thick stands of reproduction prevent the development of well formed trees. Where this occurs, a portion of the stand should be thinned out.

4. Pruning

Thin-topped trees and brushy stumps can be greatly improved by careful, inexpensive pruning.

5. Slash disposal

All slash resulting from log butts, removing overstory trees, and cutting skid trails and roads should be disposed of. It decreases the fire hazard and makes it easier to get around during the harvest.

6. Planting

Open areas are unproductive. They should be planted to Douglas fir.

⁶ Ross A. Williams, "Christmas Trees, -- A Profitable Farm Crop", (unpublished paper), 1947, pp. 11 and 12.

7. Roads and skid trails

The cost of harvest can be greatly reduced by a good system of skid trails and roads. Old trails should be brushed out and new ones cut where necessary.

8. Protection

Protection from fire and overgrazing is a necessity.

It should be understood that all areas now in Christmas tree production or areas which may be put under management for Christmas tree production will not necessarily require all of the practices listed above. They have been included only as a suggestion for further improvement of areas devoted to Christmas production.

CHAPTER VI

POSSIBLE RETURNS UNDER A PROGRAM OF SUSTAINED YIELD

Methods of producing and marketing, type of land suitable for production of Christmas trees, present management practices and problems, and management practices that are desirable for maximum production have been discussed. To tie all of these ideas together and show where they must be considered and why they must be considered in the business of producing trees for Christmas tree use, a theoretical case example will be used. This case example is based on an area very similar to an ownership now under production. The history of the area is well known and the same general pattern of development will be suggested in the case example.

For purposes of comparison, cost of development and net returns will be computed from the standpoint of a farmer-owner and an absentee-owner. This procedure will point out comparative financial advantages of on-the-land ownership, and will also show whether absentee ownership is worthwhile from the standpoint of an investment.

Case Example of an Area Considered for Purchase as Christmas Tree Land

In order to set the stage for subsequent figures and costs, the following assumptions are made:

1. The area is located near Somers, Montana in the Larch-Douglas fir type.
2. The area was logged by horses in 1930.

3. The total area is 320 acres, and the sale price is \$10.00 per acre, or a total price of \$3200.00.
4. The down payment required by the owner is \$320.00, and the balance may be paid off in five or ten equal payments at 4 per cent interest.
5. The land is deeded and of clear title.

Before purchase of this area is made, three things should be done. First, a careful reconnaissance of the area must be made. Second, neighboring owners should be contacted, and third, calculations should be made, based on probable returns, in order to determine whether purchase is economically feasible.

Reconnaissance of the Area

A reconnaissance of the area in question is made and the following information about the area was obtained:

1. Accessibility
 - a. Condition and extent of roads -- the only road on the area is an old timber access road which runs diagonally through the southwest quarter of the area.
 - b. Approximate hauling distance to an oiled highway -- the area lies approximately six miles west of the Polson-Kalispell highway.
 - c. Distance of haul to the buyers concentration yards -- the distance of haul from a suitable opening for a woods yard along the road to the highway is about six and a quarter miles. From this point on the highway it is seventeen miles to Kalispell, the nearest shipping and buying center.
 - d. Road construction needed -- although all of the area is accessible from the road already on the area, approximately two miles of road should be constructed to adequately harvest the area.

2. Aspect and topography

- a. Maximum and minimum slopes -- the maximum slope on the area is 40 per cent, the minimum slope is 5 per cent.
- b. Average slope on effective area -- the average slope on effective area is about 10 per cent.
- c. What is the lay of the land? -- The west half of the acreage lies in a gently sloping flat, ascending to a side hill to the east. This slope terminates in a narrow but flat ridge in the northeast corner of the property.
- d. Aspect of the land -- about 50 per cent of the land has a south and west aspect.

3. Effective area -- what per cent of the area is effective from the standpoint of tree production as indicated by growing conditions found on the area? -- At least 70 per cent of the area is effective. Growing conditions on the flat and on the ridge are excellent. The area on the side hill, especially at the foot of the slope has too heavy an overstory for effective production. Parts of the side hill have overgrown Christmas tree sites.

4. Overstory

- a. Amount and condition of overstory -- on the flat and on the ridge the overstory runs from fifteen to twenty-five trees over fourteen inches in diameter, per acre. On the side hill, volumes appear to run 1500 to 2000 BFM per acre of larch and fir over twelve inches in diameter.
- b. Approximate volume of merchantable timber on the area -- there is an estimated volume of 416 M board feet of larch and fir over twelve inches in diameter, on the area.
- c. Mills or wood products plants in or near the area -- there are several wood products plants in Kellsell, and a local sawmill will purchase larch and fir over twelve inches in diameter at a stumpage rate of \$3.00 per MBM.

5. Reproduction

- a. Extent and condition of reproduction -- reproduction under four feet in height is adequate for future growing stock.

- b. Areas in need of planting -- only one area of less than five acres is in need of planting. It may be that this area will be used for a Christmas tree yard.
- c. Planting stock -- if it is decided to plant the area mentioned above, planting stock may be obtained from the Forestry School Nursery at Missoula at a cost of \$15.00 per thousand for 2-2 Douglas fir stock.
- d. Extent of damage from disease and insects -- damage from insects and disease is negligible. There is a narrow belt of blight present along the foot of the hill. About ten acres are involved. No insect damage was observed.

7. Grazing and browsing

- a. Extent of damage -- no evidence of grazing or browsing damage by cattle or deer was apparent.
- b. Amount of fencing necessary -- no fencing will be necessary.

8. Corners and lines

- a. Are boundaries easily discerned? -- All lines are well marked by recent blazes.
- b. Section corners and markers -- all section corners were located. Two of the three one-quarter corners were found.
- c. Re-surveys necessary -- there will be no need for any re-surveys to establish property lines.

9. Competing species

- a. Species seriously competing with Christmas tree growing stock -- no serious competition is present. The only competing species is advanced larch reproduction.
- b. Amount of thinning needed and best time to thin -- the amount of advanced larch reproduction is such that thinning may be best accomplished during the harvest season.

- 10. Rock and dead and down material -- rock outcroppings are present on the shoulder of the ridge. Dead and down material is negligible. Neither will be a hazard to harvesting operations.

Contact with Neighboring Owners

Contact with neighboring owners was made and the following information was gathered:

1. Marketing information

- a.. Number of companies operating in area -- three buyers for three of the largest Christmas tree companies are present in the locality.
- b. Truckers operating in the area -- four truckers bought trees from this area in 1947.
- c. Prices paid by truckers and companies in 1947 --
 - 1) Truckers paid an average of \$1.40 per bale for trees baled in the woods in 1947.
 - 2) Companies paid an average of 90¢ per bale in this area for trees loose in the woods in 1947.
- d. Expected sale prices in 1948 -- average prices are expected to be the same in 1948 as those paid in 1947.
- e. The way companies and truckers bought in the area for 1947 season -- two company buyers bought loose in the woods in 1947. The third, bought trees baled and delivered in Some rs. Truckers in area all bought baled in the woods.

2. Labor situation

- a. Labor available for cutting -- local cutters of good reputation can be hired for \$12.50 to \$15.00 per day.
- b. Labor available for hauling -- two farmers in the locality will haul trees loose to Kalispell for 10¢ per bale.

3. Expected yields -- neighboring owners' areas are on the average 70 per cent effective. These effective areas have averaged a yield of twenty trees per acre per year, under minimum management practices of thinning, pruning, and stump culture, carried on during the harvest season only.

Rough Calculations to Determine Feasibility of Purchase

From the reconnaissance, the area was found to be 70 per cent effective. Under minimum management practices yields of twenty trees per acre per year are assumed. Annual gross returns from Christmas trees then, at the average price of 90¢ per bale would be \$1008.00.

In addition to \$1008.00 per year gross returns from Christmas trees, the reconnaissance showed 416 MBM of merchantable fir and larch, which at \$3.00 per MBM for stumpage would yield approximately \$1250.00 total net return from the area.

If the purchaser had \$320.00 for a down payment his annual payments less taxes and fire protection would be about \$556.00 on the ten year plan, and about \$647.00 on the five year plan.

Thus, there is a margin of \$384.00 and \$652.00 for the five and ten year payment plans, respectively, between annual payment costs and expected annual returns. Assuming costs of production of the trees and taxes and fire protection will not exceed these margins, then purchase of the area under either the five or ten year period with no other capital than the down payment of \$320.00, is economically feasible.

Possible Yields and Returns of the Sample Area

Assume the area is purchased, Based on the information from the reconnaissance and contact with neighboring owners, Table X shows the probable gross returns from the area per year.

TABLE X

PROBABLE GROSS RETURNS FROM
CHRISTMAS TREES OF 320 ACRE CASE EXAMPLE

Total area (acres)	320
Net acreage (70 per cent)	224
Effective yield trees per acre per year*	20
Total net yield (trees per year) (20 x 224)	4480
Total net yields (bales) (four per tree)	1120
Expected price per bale (sold loose in woods)	.90
Expected gross returns (.90 x 1120 bales)	\$1008.00

* It is assumed that the management practices now in use by private growers will be used. Regardless of the purchaser, thinning, weeding, pruning, stump culture and lopping, a scattering of all brush will be done in the best manner possible by whoever cuts the area. Thus, we may assume that the average effective yield per acre per year obtained, will be the same as the average computed on the twenty-seven study areas.

Costs of Producing the
Expected Yield of the Sample Area

The cost of producing the expected yield of 4480 trees will be figured from the standpoint of the farmer-owner and the absentee-owner.

Fixed costs of production

Fixed costs from the standpoint of either purchaser are the down payment, annual payment, taxes, and fire protection. Tables XI and XII show these fixed costs per year for the five and ten payment plan respectively.

An additional fixed cost would be the construction of two miles of road. This road is needed to adequately harvest the area. Cost of construction is estimated at \$100.00 per mile. This cost will be spread over two years since harvesting in 1948 and 1949 will not depend too heavily on the construction of these roads.

Costs of harvesting from the standpoint of a
farmer-owner and an absentee-owner

Costs of harvesting for the absentee-owner will be higher than that of the farmer-owner, since all work must be hired. By selling his trees loose in the woods the absentee-owner may forego the purchase of trucks, or hiring expenses of hauling. The steps of production and their costs, figured from a hiring standpoint are as follows:

1. Brushing out of skid trails -- before cutting begins brushing out of skid trails will be necessary. A man could be hired at

TABLE XI
FIXED COSTS DURING PAY PERIOD ON FIVE PAYMENT PLAN

Year	To interest	To principal	Total annual payment	Taxes	Fire Protection costs	Total Fixed costs
1948	Down payment	\$520.00	\$520.00	16.00	16.00	\$ 552.00
1949	\$ 115.20	\$ 531.75	646.95*	16.00	16.00	678.95
1950	96.93	555.00	646.93	16.00	16.00	678.93
1951	71.81	575.12	646.93	16.00	16.00	678.93
1952	46.61	596.12	642.73	16.00	16.00	678.73
1953	24.66	622.05	646.71	16.00	16.00	678.71
Total						\$ 3749.66

* Annual payment on remaining principle of \$2880, computed as follows:

$$s = \left[1.04 \left(\frac{1.04^n}{1.04^n - 1} \right) \right]$$

where: s = annual payment
 = principle or \$2880
 1.04 = 1.04 since rate of interest is 4 per cent
 n = number of payments, or five in this case

TABLE XII

FIXED COSTS DURING PAY PERIOD ON TEN PAYMENT PLAN

Year	To interest	To principal	Total annual payment	Taxes	Fire Pro-tection	Total fixed costs
1949	Down payment		\$ 320.00	\$ 16.00	\$ 16.00	\$ 352.00
1949	\$ 116.20	\$ 239.99	355.19*	16.00	16.00	387.19
1950	106.64	249.55	355.19	16.00	16.00	387.19
1951	96.67	259.52	355.19	16.00	16.00	387.19
1952	86.28	269.91	355.19	16.00	16.00	387.19
1953	74.48	280.71	355.19	16.00	16.00	387.19
1954	63.25	291.94	355.19	16.00	16.00	387.19
1955	51.57	303.62	355.19	16.00	16.00	387.19
1956	39.43	315.76	355.19	16.00	16.00	387.19
1957	26.80	328.39	355.19	16.00	16.00	387.19
1958	13.66	341.53	355.19	16.00	16.00	387.19
Total						\$ 4233.95

* Annual payment on remaining principal of \$2980, computed as follows:

$$a = s \cdot l.op \left(\frac{l.op^n}{l.op^n - 1} \right)$$

where: a = annual payment

s = principle or \$2980

l.op = 1.04 since rate of interest is 4 per cent

n = number of payments, or ten in this case

\$10.00 per day for this work. Approximately five days would be necessary, or a total cost of \$50.00.

2. Cutting -- good cutters may be hired at \$15.00 per day. At this rate, cutters could be required to trim stumps, prune, and lop and scatter all brush. They would also be required to yard the trees to skidding points. Production would probably not exceed 250 trees per day per cutter. Using a production of 200 trees per day per cutter, the production of 4460 trees would then require twenty-three man days or a total of \$345.00 (23 days x \$15.00).
3. Skidding and sorting -- a man to skid and sort with his own equipment could be hired for \$15.00 per day. Figuring skidding and sorting time at approximately one-half of total cutting days, or twelve days, the cost of skidding and sorting would be \$180.00 (12 days x \$15.00).

Total costs of production on a hired basis then, would be:

Brushing out of skid trails	\$ 50.00
Cutting	345.00
Skidding and sorting	<u>180.00</u>
	\$ 575.00

A farmer, stands to make a larger net return than the absentee-owner since he can do his own cutting and use his farm equipment for skidding. From a strictly business standpoint, however, the farmer should pay himself wages for his work, and charge his equipment operating costs as a cost of production. On this basis, the farmer-owner's costs of production would be as follows:

1. Brushing out of skid trails -- figured at \$10.00 per day for five days, total cost would be \$50.00.
2. Cutting -- assuming the same production of 200 trees per day, and twenty-three days of cutting at \$10.00 per day, total cost of cutting would be \$230.00.
3. Skidding -- a fair charge for his equipment used in skidding would be about \$2.00 skid-load. Skidding of each days cut would be done at the end of two days' cutting, and would require

about two hours. There would be no labor charge for skidding, but twelve skid-loads would be necessary. Therefore, total cost of skidding would be \$24.00.

4. Sorting -- preliminary sorting would be done when each skid-load is brought to the yard. There would be no labor charge for this preliminary sorting. Prior to selling the trees loose in the woods, however, about two days of re-sorting would be necessary. At \$10.00 per day for re-sorting, total charges for sorting would be \$20.00.

Total costs of production of the farmer-owner then, would be:

Brushing out of skid trails	\$ 50.00
Cutting	250.00
Skidding	24.00
Sorting	<u>20.00</u>
Total	\$ 324.00

Costs and Net Cash Receipts on the Sample Area from the Standpoint of the Farmer-owner and Absentee-owner

A comparison of Tables X, XI, and XII show that even under minimum management practices, the absentee-owner cannot afford to purchase the area on the five payment plan, since his fixed costs, and costs of production exceed probable gross cash receipts. The farmer can, however, purchase the area on the five payment plan, although the net cash receipts without the additional return from expected stumpage sales is very low.

Assuming then, that purchase of the area is made on a five payment plan by the farmer-owner, and on the ten payment plan by the absentee-owner, Tables XIII and XIV respectively, show the net cash receipts possible from the sample tract under discussion. These figures are based on the minimum management practices of thinning, pruning, stump culture, and

TABLE XIII

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR 320 ACRES OF CHRISTMAS TREE LAND -- FARMER-OWNER

Year	Source of gross cash receipts from the area	Cash Disbursements		Excess of cash receipts over cash disbursements	Cash receipts
		Cost of harvest	Land costs		
1948	Christmas trees	\$1008.00	\$ 324.00	\$ 352.00*	
	Stampage	625.00	0.00	100.00**	
		<u>1633.00</u>	<u>324.00</u>	<u>452.00</u>	\$ 857.00
1949	Christmas trees	\$1008.00		678.93***	
	Stampage	625.00		100.00	
		<u>1633.00</u>	324.00	<u>778.93</u>	229.07
1950	Christmas trees	1008.00	324.00	678.93	6.07
1951	Christmas trees	1008.00	324.00	678.93	6.07
1952	Christmas trees	1008.00	324.00	678.93	6.07
1953	Christmas trees	1008.00	324.00	678.93	6.07
Total					\$1110.55

* Down payment plus taxes and fire protection costs

** Cost of 1 mile of road -- second mile of road is delayed until 1949

*** Annual payment plus taxes and fire protection costs (Table XI, p.78)

TABLE XIV

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR 520 ACRES OF CHRISTMAS TREE LAND -- ABSENT-OWNER

Year	Source of gross cash receipts from the area	Cash Disbursements	Excess of cash receipts over cash disburse- ments	Cash receipts	
		Cost of harvest Land costs			
1948	Christmas trees Stampage	\$1008.00 625.00 <u>1633.00</u>	\$ 575.00 0.00 <u>575.00</u>	\$ 353.00* 100.00** <u>453.00</u>	\$ 606.00
1949	Christmas trees Stampage	1008.00 625.00 <u>1633.00</u>	575.00	337.19*** 100.00 <u>437.19</u>	1176.81
1950	Christmas trees	1008.00	575.00	337.19	1222.82
1951	Christmas trees	1008.00	575.00	337.19	1269.43
1952	Christmas trees	1008.00	575.00	337.19	1314.24
1953	Christmas trees	1008.00	575.00	337.19	1360.05
1954	Christmas trees	1008.00	575.00	337.19	1405.86
1955	Christmas trees	1008.00	575.00	337.19	1451.67
1956	Christmas trees	1008.00	575.00	337.19	1497.48
1957	Christmas trees	1008.00	575.00	337.19	1543.29
1958	Christmas trees	1008.00	575.00	337.19	1589.10
Total					\$ 1559.10

* Down payment plus taxes and fire protection costs

** Cost of 1 mile of road -- second mile of road is delayed until 1949

*** Annual payment plus taxes and fire protection costs (Table XII, p.78)

lepping and scattering of all brush carried on entirely at the time of harvesting. In the case of either purchaser, it is assumed that the only capital invested was \$320.00, or the down payment.

Note that the original capital of \$320.00 might have been borrowed at 5 per cent interest for one year and expected cash receipts would allow repayment and still leave a considerable accumulated net return at the end of the chosen pay period.

Degree of Management Possible on the Sample Area

All preceding costs and returns have been based on the assumption that management practices shall be entirely carried out during the harvest cutting. More intensive management will surely increase production, but as yet no one knows how much. There are four main steps which should be taken to place an area under intensive management. A discussion of these steps and their economic feasibility on the sample area follows below.

Development of the road system

First, the area must be made accessible by an adequate road system for harvesting. Yarding distances should be kept to a maximum of 150 feet where possible. Thus, the distance between skid roads should not exceed 300 feet. Optimum skidding distances for all types of equipment would be one-quarter of a mile. None of the roads should exceed a 10 per cent favorable grade since their heaviest use is during wet or snowy weather. To maintain this grade limitation and keep road spacing so that skidding

will not exceed a quarter of a mile, two miles of truck road construction will be needed (Fig. 1).

Skidding roads should not be over 300 feet apart, and in order to keep within this limit approximately eight and a half miles of skid roads are necessary (Fig. 2).

The cost of constructing suitable truck roads is approximately \$100.00 per mile. A D-8 caterpillar bulldozer can be hired for \$10.00 per hour, and this type of road can be punched out at the rate of one mile in about eight to ten hours. Average costs of constructing two miles of roads would amount to approximately \$160.00. The grade line and center line staking would cost about \$40.00. Total truck road costs would be about \$200.00.

Except on the side hill, skid roads usually require nothing more than marking by blasing and brushing out. On the side hill, skid roads may require the use of a small dozer to cut into the side hill. Skid roads with a favorable grade of 3 to 5 per cent are desirable. Maximum grades for short distances should not exceed 20 per cent. Approximately four miles of skid road will be on the side hill (Fig. 2). Cost of these skid roads would be about \$25.00 per mile or about \$100.00 for dozer work. Layout of all skid roads would cost about \$5.00 per mile. At this rate, surveying the layout of skid roads would cost \$45.00. Total skid road costs are estimated at \$150.00.

Total development of a road system for the area allowing a maximum

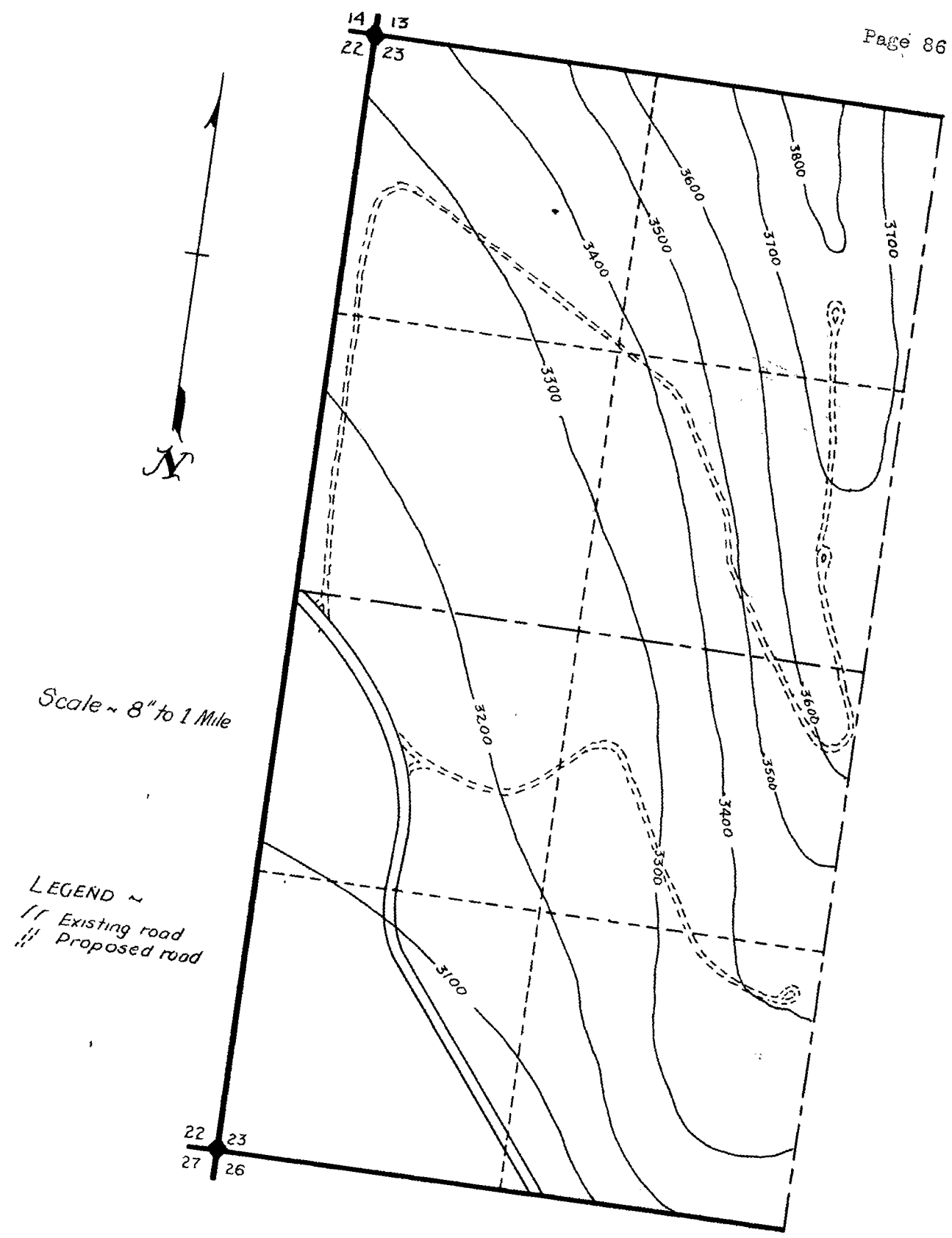


FIGURE 1.
PROPOSED ROAD DEVELOPMENT ON SAMPLE AREA

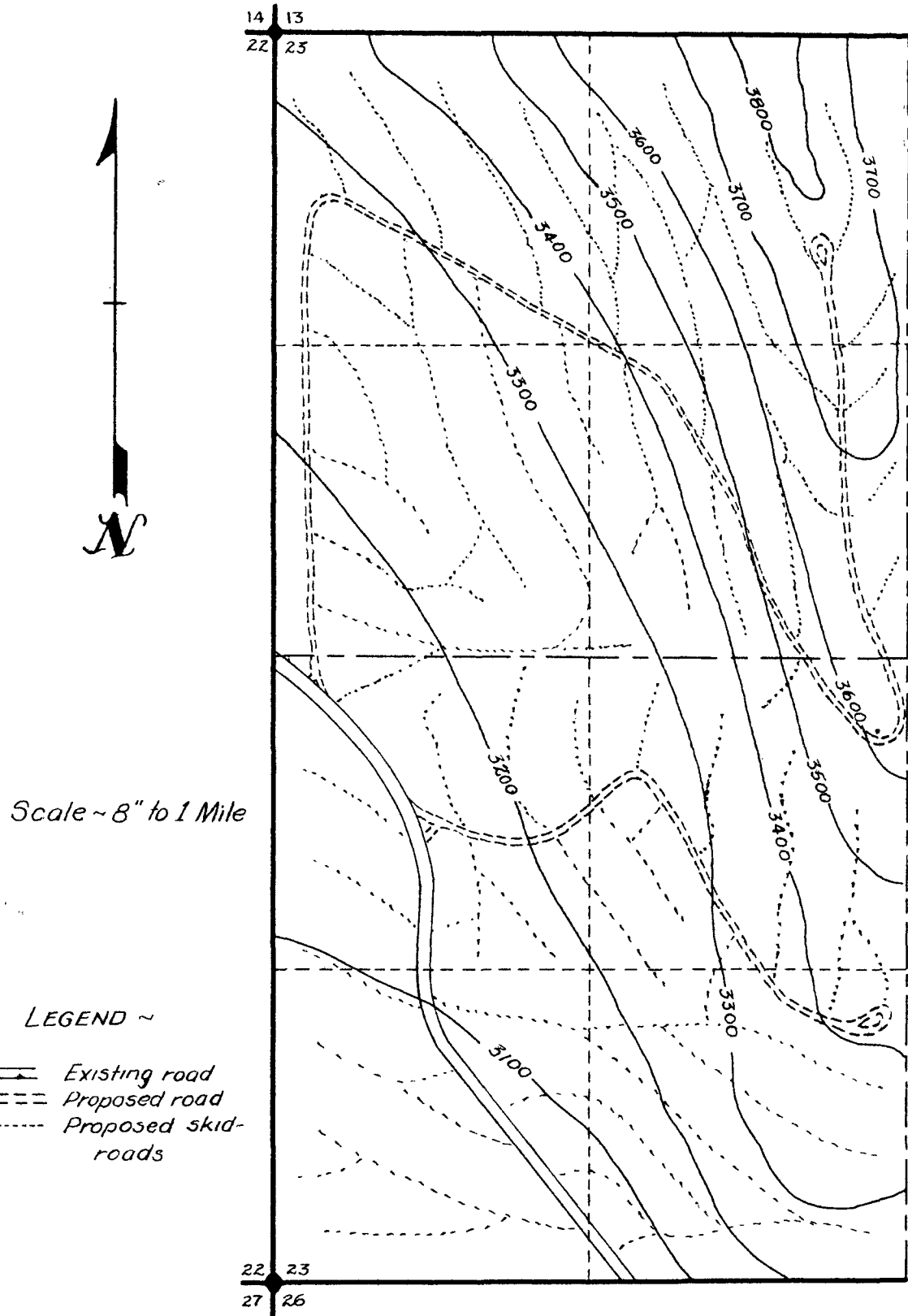


FIGURE 2
PROPOSED SKID-ROAD LAYOUT

of 150 foot yarding distances, and maximum skidding distances of one-quarter of a mile, are estimated at approximately \$350,00.

Reduction of the overstory

Second, reduction of the overstory. Removal of the larger trees in the overstory can be best handled through the sale of the merchantable timber as stumpage. Reconnaissance of the area indicated the presence of approximately 416 MBM of merchantable larch and fir. Sale of this timber in two cuts one year apart would carry road construction expenses the first two years. Timber should be marked so as to leave at least ten to fifteen well distributed trees per acre. Six to ten of these should be seed producing fir trees above six inches in diameter at breast height. The returns from this stumpage at \$3.00 per thousand would amount to approximately \$1250.00 total, or \$625.00 each cut. (Table XIII and XIV, pages 82 and 83).

Removal of the trees under merchantable size will probably require a direct expenditure of time and money. Use of this material for fence posts, corral poles and fuel wood might pay for the cost of the operation but unless markets for such material are close by, no returns should be anticipated. As many as possible of the larger trees should be utilized as "topper trees" during the harvest season. Remaining trees in the overstory should be worked out of the stand during a season in which woods work can be most cheaply hired. On the area under discussion about 30 per cent of the area will require this type of work. Assuming ten or fifteen

truss to the more of unmarketable material from the standpoint of marketable timber or Christmas trees, cost of removal would probably run \$5.00 per acre or about \$60,000. Assuming that this work is to be carried over a period of five years, this improvement cost would be about \$100,000 per year.

Inspection of Tables XIII and XIV (pages 83 and 85) show that this expenditure could be easily borne during the first five years of ownership. From the standpoint of increasing the effective area alone, such an expenditure would be a wise investment of time and money, since total net yields would be increased by 14 per cent⁷ at the end of five years. Reduced to the number of bales increase, at say \$1.00 per bale, the improvement investment of \$100,000 per year for five years would return \$180,000 per year thereafter. The investment needed to reduce the overstory for optimum Christmas tree growth then, while a direct expense at the outset is economically sound in that expected yields will in time exceed the cost of the investment through increase of quality and yields per acre.

Regulation of cut and scheduling of cultural work

Third, regulation of cut and scheduling of cultural work. The present effective acreage of the area is about 70 per cent (see Fig. 3).

With the anticipated road system, the cutting will take place in the five

⁷ Assuming reduction of overstory by logging, and investment of \$100,000 per year increased the effective area to 80 per cent at the end of five years, then expected yields would be \$120 trees or an increase of 800 trees over 4800 trees, or an increase of 14 per cent.

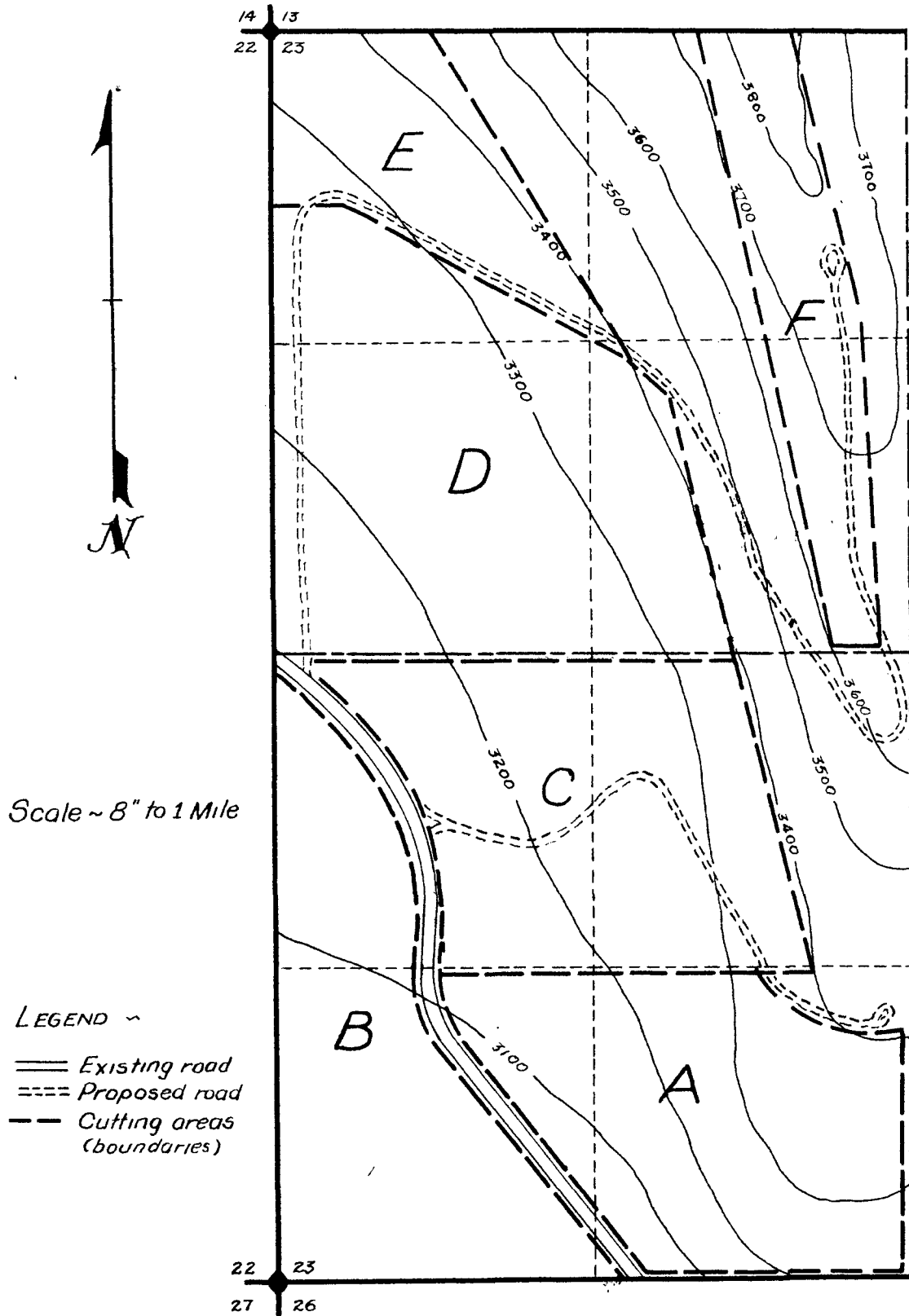


FIGURE 3
DESIGNATION OF CUTTING AREAS

areas shown in Figure 3 as follows:

- Area A --- 48 acres --- out 1948
- Area B --- 48 acres --- second cut 1954
- Area C --- 46 acres --- second cut 1955
- Area D --- 55 acres --- second cut 1959
- Area E --- 19 acres --- second cut; 27 acres --- first cut 1957
- Area F --- 18 acres --- second cut; 53 acres --- first cut 1969
- Area A --- 49 acres --- third cut 1959
etc.

On a six year cutting cycle it would be desirable to carry on the following cultural schedule:

1. Pruning

- Area A --- cut 1953
pruned 1956
cut 1959

Note: Area would be pruned two years after cutting so as to insure only those trees needing pruning. Four years would pass before cutting, allowing adequate time for most pruned trees to develop.

2. Stump culture

- Area A --- cut 1955
culture stump 1955
trim up cultured stumps 1958
cut 1959

Note: Since an investment is to be made for cultural practices, stumps will be left two years before any trimming is done. After trimming the stump should be re-trimmed in three years. Some trees will be ready for 1959 cutting, the remainder would be cut in 1965.

The amount of pruning and stump culture then for any one year will be approximately fifty acres of re-trimming trees, trimmed for stump culture three years before, on a different area.

Cultural practices

And fourth, carrying on cultural practices which are economically

feasible. The amount of money, and time other than during the cutting season, which can be economically invested in cultural practices is not known.

The cost of pruning has been estimated at $1\frac{1}{2}$ per tree according to cost figures on plots pruned by the state.⁸ The possible increase in yields from such pruning is not known. Further studies are needed to determine how much of an investment in pruning is feasible from an economical standpoint.

Stump culture has proven to be an economically sound practice from the standpoint of increase in quality and increased yields through a shorter rotation age. Costs of stump culture have been estimated at $5\frac{1}{2}$ per tree.⁹ Assuming fifteen to twenty years of age as average for a naturally grown six foot tree, production of the same tree from a "turn-up" may shorten the growth period required as much as 75 per cent. If 10 per cent of the trees were produced from stumps, an increase of 10 per cent in effective yields may be expected within two cutting cycles.

Assuming the cost of $1\frac{1}{2}$ per tree for pruning and 1200 trees per acre to be pruned, according to the schedule set forth on page 91, cost of pruning would be fifty acres x 1200 trees per acre x $1\frac{1}{2}$ per tree or

⁸ E. A. Anderson, Assistant State Forester -- verbal information gathered on pruned plots near Bigfork and Kalispell, Montana, 1948.

⁹ Bud Jinks of Somers, Montana -- verbal information gathered while on his Christmas tree area during interview of February 1948.

\$500.00 per year.

About 10 per cent of the trees will be suitable for stump culture. Figuring 10 per cent of 1200 trees per acre or 120 trees per acre at 5¢ per tree, stump culture would cost \$6.00 per acre. From the schedule for stump culture on page 91, the cost of this work on fifty acres would be about \$300.00 per year. This stump culture will be on the same area as the pruning proposed above.

Total costs of pruning and stump culture of any one area for any one year then would total \$900.00.

Assuming the cost of re-trimming a stump three years after its original culture, is half of the original investment, the acreage would be the same and the same trees would be re-trimmed, therefore this cost would be estimated at \$150.00.

Total cost of all cultural work would average \$1050.00 per year. That such an ambitious schedule of cultural work would be prohibitive is conceded at once. Yields would have to be increased 100 per cent almost immediately in order to pay the way of suggested cultural work. Therefore, it is suggested that stump culture and pruning be done at the time of cutting for at least the first two cutting cycles. At the end of this period, yields may increase to the point where cultural work may be economically feasible at a time other than the harvest cutting.

Yields Possible Under Intensive Management

No one knows what yields are possible under intensive management. Assuming that proper vertical and horizontal spacing is given to each tree, and that each tree is a potential Christmas tree, yields of 200 to 250 trees per acre per year are theoretically possible.

Data from one grower's yields records show that his area has produced forty trees per acre per year on effective averages for over fifteen years. Considering that his management is carried on entirely in the out-thing season, it would be reasonable to assume that intensive management would allow sustained yields of at least double this production.

Actually until further studies are made, in all of the producing areas in Western Montana and under the various growing conditions present, any figure advanced as possible yields per acre under intensive management is only an estimate.

Economic Possibility of Sustained Production

Sustained production of trees has been shown to be economically possible under the minimum of management practices. More intensive management, and subsequently greater yields, depends entirely upon the degree of management that an owner feels is economically feasible for that particular ownership. The intensity of management should be increased gradually, so that the greater yields pay for the more intensive practices.

As soon as yields increase approximately 100 per cent, management

practices necessary for best quality trees can be carried on as a regular part of the operation.

It is a fact, however, that on many of the areas observed, sustained production of Christmas trees is economically possible under current management practices.

CHAPTER VII

SUMMARY AND CONCLUSIONS

In a span of twenty-one years the Christmas tree industry in Western Montana has become a million dollar industry. The number of trees cut each year is no more significant than the employment their harvest provides. It is this employment, for whole communities, which makes the industry so important to Western Montana.

Ideally blessed for farmer participation, Christmas tree production provides additional use of equipment and hired help. Thus, it becomes an important adjunct to the farm economy.

Some segments of public opinion have long derided the cutting of young trees for Christmas tree use. Actually, proper harvesting of Christmas trees is good forestry, since land suitable for Christmas trees is usually poor land for saw timber growth.

For small owners and farmers, the Christmas tree is the best forest product on his land. It is about the only forest crop in the region which may be harvested regularly at short intervals.

A systematic study of privately owned lands was made during the fall and winter of 1947-48. Objects of the study were to determine (1) how the industry is conducted, (2) what land is suitable for Christmas tree production, (3) what are effective management practices, (4) what are yields under present practices, and (5) what yields are possible under management.

A total of twenty-seven growers was interviewed, and twenty of the

areas owned by these producers were covered in detail. In addition to growers, contacts were made wherever possible with buyers, professional cutters and others directly connected with various phases of the industry.

Production methods were discussed in two parts, woods practices and yard practices. Under woods practices, cutting, yarding, skidding and sorting of the trees as done on private lands were outlined.

Cutting usually starts about October tenth and ends about November twenty-fifth. Trees should not be cut until they are dormant, as loss from premature shedding is likely to result. All but two of the growers cut with an axe since it is faster and more versatile, although the new probably causes less wounding and may be best for intensive management. Most owners prefer to do their own cutting, or hire inexperienced cutters and train them themselves. They say that a young man makes the best cutter, and that the secret of good cutting lies in the ability to cut rapidly, trees which meet minimum market specifications.

Cutting usually involves cutting the tree, trimming it, yarding and disposal of the slash. Expert cutters whose sole job is to cut and trim the tree, can cut up to 500 trees per day in good stumpage. Cutters required to yard, and lop and scatter the brush do well to cut 200 to 250 trees per day, the average being 150 to 200 trees per day.

Professional cutters prefer to work on the piece basis, but most growers prefer to hire on the hourly basis since better cutting is the general result. Piece cutters were paid from 25¢ to 50¢ per bale in

1947. Hourly wages ranged from \$1.00 to \$1.50.

Outting on National Forest, State and some of the larger private lands is subject to written regulations by these agencies. Most small owners and growers regulate outting entirely by personal instruction.

Yarding of trees is usually done by the outters and is defined as removing the trees from the stump to a skid road for removal to the Christmas tree yard. Trees should be carried to skidding points whenever possible. Dragging of trees is a universal mal-practice. The one exception is when there is a light cover of fresh snow. Damage is certain if there is the lightest crust on the snow. Skidding roads should be placed so that yarding distances do not exceed 150 feet at the maximum. Seven of the areas observed met this standard of accessibility. Only one operator required that his trees be carried.

Skidding is the next step in production. It is defined as the method of moving the trees from yarding points to the Christmas tree yard. This step is usually eliminated when areas are entirely accessible by truck roads.

Methods of skidding vary with the growers financial means. Horses or tractors with go-devils are the most commonly used equipment. Average skidding distances with this equipment is one-third to one and one-half miles, respectively.

After the trees are skidded to the woods yard, they are sorted to

size. Grading of the trees by the owner is done at this time. Trees are usually graded according to the specifications required by the buyer to whom the owner expects to sell.

Typical practices include inspection in the woods, hauling, re-sorting, tagging, tying or baling, and loading for shipment. The Christmas tree companies usually provide inspectors who grade the trees in the woods. If sold, they are then hauled by truck to the concentration yards, and re-sorted, tagged, baled and loaded for shipment. The farmer or owner own, of course, carry out these operations himself and thus market his labor and equipment to the marketer.

Approximately 85 per cent of the 1947 production was handled by the large Christmas tree companies. Eight such companies operated in Western Montana in 1947. Most of the remaining production was purchased by independent truckers. Probably not more than 1 per cent of the 1947 production was retained directly by the growers themselves.

There are six ways in which a grower may sell his trees. They are (1) loose in the woods, (2) baled in the woods, (3) delivered loose, (4) delivered baled, (5) selling stumpage, and (6) the lump sum sale. Some growers retail their trees directly. Over 50 per cent of the growers sold their trees by method (1). Methods (5) and (6) are not recommended for most growers.

Use of a written contract in selling trees is virtually unknown. Sharp business practices can be eliminated by use of such a contract and is recommended.

Christmas trees come from three sources. "Toppers" are cut from the tops of large saplings or medium sized poles, "ground trees" are cut at regular stump height, and "limb trees" are produced when a limb on a freshly cut stump turns up to assume the place of the main stem.

A desirable Christmas tree must have good color, heavy foliage, a dense compact crown, and a symmetrical form. Good Christmas tree land is obviously land on which a desirable combination of growing conditions produces this type of tree. Within the natural range of the Larch-Douglas fir type, the best trees were found on the ridges, flats and benches and on the slopes on the south and west aspects within the intermediate to poor sites. In the northern range of the Ponderosa pine type, Douglas fir admixtures occur on the lower slopes and ridges, and moisture conditions are such that quality growth exists on all aspects except on the most northern exposures. Near Derby, Montana, moisture conditions are such that fir only occurs on the most northerly aspects and in deep, protected draws.

Generally speaking, cut-over land, well stocked with advanced fir reproduction prior to logging, and reproducing naturally to fir after logging, makes the best possible Christmas tree land.

Six criteria of suitable Christmas tree lands were indicated. Aspect is of local importance as an indicator of moisture conditions; soil is most reliable; overstory is an indicator of adequate seed source and possibilities of sustained production; reproduction must be present for

sustained production, and is the growing stock of the area; logging history is a key to the presence of advanced reproduction, and overall accessibility of the area; and, accessibility is the most important of the six criteria. It should be recognized that these factors should not be accepted as positive criteria, since only the most accessible areas were covered in this study. Other areas now beyond present limits of production may differ, and these indicators may well be very in now undeveloped areas. Lack of these criteria may be of little importance on an area where quality trees, and possibilities of sustained production exist.

Management practices for the production of Christmas trees as a crop, must be designed to produce trees of a form suitable for Christmas tree use. If Christmas trees are to be produced on a sustained yield basis, then management techniques must be designed to hold the stand in a state of arrested development.

Regulation of cut, cultural operations of thinning, pruning, and stump culture, and slash disposal are the main management practices followed on private lands. Some of the practices are a result of scientific study, but most of them have evolved from close observation, and common sense land management. Eight-nine per cent of the growers contacted, practice management of some form or another.

All of the operators use area as a method of regulating cropping of their land for trees. The normal cutting cycle is about three years. Some operators make no attempt to regulate cutting, but most agree that

an area should not be cut more often than once every other year.

Pruning and stump culture are the main cultural operations practiced on private lands. Trees are pruned with the idea of slowing growth and thus improving crown density and symmetry. That pruning is a worthwhile management practice is a matter of conjecture among some foresters and owners, yet 70 per cent of the growers contacted prune their own trees. It should be noted that 95 per cent of those growers who prune, carry out this operation during the harvest cutting. Stump culture is one of the most interesting and worthwhile management practices. Limbs remaining on freshly cut open-grown stumps tend to turn up. If properly trimmed, they will form quality Christmas trees. The number of trees possible from one stump is unknown. Approximately 75 per cent of the growers contacted practice stump culture in one form or another. It should be noted that 55 per cent of the growers trim stumps for culture during the harvest cutting.

Thinning and weeding are usually done during cutting. Constant cropping of an area will usually accomplish these operations to a degree commensurate with the expense of the operation.

Slash disposal ranges from none to complete logging and scattering of the brush. Over 50 per cent of the owners contacted, contend that slash will disintegrate, and make no attempt to handle it in any way.

The degree of management practiced by any one operator is usually dictated by the time available for such work. If better management is to

be carried on, then management practices advocated must either be carried on during the harvest cutting, or worthy of the time they require.

Problems of management were expressed by seventeen of the growers in the following order of importance: disease and insects; snow damage; logging damage; excessive overstory; browsing; accessibility; and utilization of long-butts. The most important disease is the needle cast of Douglas fir or "blight". An insect which may cause trouble is the Cooley's gall louse. No feasible controls for disease and insects have yet been developed. Other damage may be caused by unseasonable frosts, hail, and fire.

The ownerships visited were found on the average, 58 per cent effective. Very few accurate yield records are kept. The highest effective yield on three different areas of one owner showed an effective per acre per year yield of thirty-eight trees. The average effective yields on all the areas observed was twenty trees per acre per year.

A case example of a 320 acre area was used in order to forecast possible returns under a program of sustained yield. Steps prior to purchase, namely reconnaissance, contact with neighboring owners, and rough calculations to determine feasibility of purchase, were outlined. It was found that under the conditions set forth that a farmer-owner, and an absentee-owner could purchase the area and pay for it, with a net profit under a five and ten payment plan, respectively, with a capital investment equal to the down payment of \$320.00. The degree of management

possible on the same area was discussed. Indications were that road development, and removal of the overstory were feasible management operations. Other management practices such as pruning and stump culture were indicated as uneconomical at any other time than the harvest cutting.

Yields possible under intensive management are as yet unknown. One owner's records indicated effective yields of forty trees per acre per year under minimum management practices. At this figure, yields of 200 to 250 trees per acre per year under intensive management are theoretically possible.

Sustained production of trees has been shown to be economically possible under minimum management practices. It is indicated that as soon as yields increase 100 per cent through increasingly intensive management that these practices may be carried on as a regular part of the operation. It is definitely a fact, however, that sustained production of trees is economically possible under current management practices.

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- C. A. Reilmer and A. L. Roe, Management Practices for Christmas Tree Production, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana, Station Paper No. 9, November 1947, pp. 21, (Illustr.). A pictorial account of management practices for Christmas tree production in Douglas-fir stands of the Northern Rocky Mountains.
- Williams, Ross A., "Christmas Trees -- A Profitable Farm Crop", Unpublished paper, 1945, 48 pp. A paper intended to point out the advantages of Christmas tree production to the farmer in Western Montana as an important adjunct to the farm economy.

A P P E N D I X

Following this page are samples of the two forms used in collection of the original data cited in this study. The first form was used when interviewing the owner or operator. The second, was used when the area owned by the grower was covered in detail.

CHRISTMAS TREE STUDY - Form for Collection of Data
 DATA COLLECTED BY PERSONAL INTERVIEW WITH OWNER OR OPERATOR; No. _____

I. Ownership

- A. Owner: _____
- B. Operated by: Owner _____ Tenant _____
- C. Address of Operator: _____

- D. Remarks:

II. Size and Location of Christmas Tree areas:

A. Total area owned in Christmas Tree land _____ acres.

B. Location and Land Description of Areas:

S	T	R	S	T	R
S	T	R	S	T	R
S	T	R	S	T	R
S	T	R	S	T	R
S	T	R	S	T	R

C. Are all Christmas Tree lands cut, a part of the ownership? Yes ___ No ___

- 1. Amount of land leased _____ acres
- 2. From whom leased _____
- 3. Location of leased land _____
- 4. Government Allotments - USFS _____ State _____
 Amount of acreage in allot. _____ A. Location _____
- 5. Remarks:

III. Cutting of Trees

- A. Cutting done by: Self ___ Self and hired help ___ No. of hired help ___
 Seasonal _____ Permanent _____
- B. Cutters Hired: _____
- C. Trees cut by Purchasing Company _____

Ownership _____ (Cont.)

III. (Cont.)

D. Trees sold as Stumpage _____

E. Remarks:

F. Instructions to Cutters? Yes _____ No _____

If yes, list briefly:

IV. Marketing Information:

A. Who do you sell to? _____

B. How are your trees sold? _____

C. Have you ever been dissatisfied with any buyers? _____ Why? _____

D. Do you use a written contract? Yes _____ No _____ Remarks _____

E. Do you grade your trees? Yes _____ No _____ How? _____

Opinions: _____

F. Price received per bale _____

V. Cultural Practices

A. Stump Culture: Practiced _____ Not Practiced _____

If so, how?

Ownership _____ (Cont.)

V. (Cont.)

B. Pruning: Yes _____ No _____ If yes, how?

C. Other improvements:

1. Kind -

2. Amount

VI. Management Practices

A. Is there a management plan? Yes _____ No _____

B. Is the plan written? Yes _____ No _____

C. What does the plan provide for?

D. Problems of Management

DATA COLLECTED BY TRIP INTO PARTICULAR CHRISTMAS TREE AREA:

Ownership _____

Description _____ Area _____ Acres No. _____

I. Topography:

A. General aspect of effective areas

B. Slope % - max _____ min _____ average on effective area _____

C. Amount of rock

D. Amount of Dead and down material

Is it a serious hazard to harvesting operations: Yes _____ No _____

E. Road System

1. Excellent _____ Good _____ Fair _____ Poor _____

2. Distance between roads _____ feet

F. Soil condition and type present:

G. Effective area of ownership _____ acres

II. Timber Type present

A. Major type: WWP PP LPP LDF WF ES C

B. Assoc Species WWP PP LPP LDF WF ES C J

C. Understory:

D. Overstory (approx no. of trees/A)

E. Ground cover

F. Remarks:

III. Reproduction

Ownership _____ (Cont.)

III. Reproduction:

A. Adv reprod present? Good _____ Fair _____ Poor _____

If no, reasons:

B. Seed source: Yes _____ No _____ Adequate _____ Not adequate _____

C. Remarks:

IV. Fire History:

V. Logging History:

VI. Transportation

A. How are trees transported to the Yards: Own trucks _____ Hired trucks _____
By buyer _____ By rail _____

B. Distance to nearest Yard _____ mi. To nearest shipping point _____ mi.

C. Hauling cost/bale _____

VII. Harvesting Methods:

A. Skidding

B. Loading

C. Hauling

D. Remarks

VIII. History of Cutting and Yield:

A. No. of times area has been cut for trees _____

B. Yield of each cut (bales) _____

C. Frequency of cutting on any particular area _____

D. Expected yield in 1947: _____ Yield in 1946 _____

E. Other Yield Figures if available:

F. Remarks:

IX. Damage or Disease present:

A. Type _____

B. Serious? Yes _____ No _____

C. Extent of Disease or Damage _____

D. Remarks:

Ownership _____ (Cont.)

X. Map of Ownership

Description _____ S _____ T _____ R _____ Area _____ Acres _____



Following this page is a copy of the sales agreement and special clauses, or cutting regulations required of any cutter who purchases stumpage on National Forest lands. The State and several of the large private owners who sell Christmas tree stumpage require similar sales contracts and cutting regulations.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

S
SALES

CHRISTMAS TREE SALE AGREEMENT
(TMHB, p. 22h)

National Forest

(Date)

_____, of
(I or We) _____ (Name of purchaser)

_____, hereby agree to purchase _____
(Species)

Christmas trees located on an area to be definitely designated by the forest officer
before cutting begins in _____
(Give approximate location by legal subdivisions and by

_____, estimated to be _____ trees.
drainage or well-known landmark.)

The purchaser hereby agrees to pay to the Regional Fiscal Agent, Forest Service, Missoula, Montana, or such other officer or depository as shall hereafter be designated, by remittance in favor of the Treasurer of the United States, to be placed to the credit of the United States, the sum of \$ _____, more or less, as may be determined by actual count of the trees, at the rate of:

- _____ ¢ per tree for trees less than _____ feet in length
- _____ ¢ per tree for _____ foot trees; _____ ¢ per tree for _____ foot trees
- _____ ¢ per tree for _____ foot trees; _____ ¢ per tree for _____ foot trees
- _____ ¢ per tree for _____ foot trees; _____ ¢ per tree for _____ foot trees
- _____ ¢ per tree for _____ foot trees; _____ ¢ per tree for _____ foot trees

in advance payments of at least \$ _____ each when called for by the forest officer in charge.

In addition to making payments for trees, as herein provided, the purchaser further promises and agrees to deposit in the above-designated depository, when called for by the forest officer in charge, such sum or sums as will amount to _____ cents per tree for the total cut of trees, merchantable under this agreement, to be covered into the Treasury of the United States as a special fund for paying the cost of (1) planting (including the production or purchase of young trees), (2) sowing with tree seeds (including the collection or purchase of such seeds), or (3) cutting, destroying, or otherwise removing undesirable trees or other growth on the national forest land cut over by the purchaser, in order to improve the future stand of timber. Such deposits are not subject to refund except as they may be in excess of the amount actually found due under the provisions of this section. (Act of June 9, 1930; 46 Stat. 527.)

(Above clause to be stricken out if not applicable.)

The purchaser further promises and agrees to cut and remove said trees in strict accordance with all conditions and requirements in special clauses hereto attached and with the regulations governing sales of forest products prescribed by the Secretary of Agriculture.

Unless the time is extended by the forest officer, all trees shall be cut and removed on or before, and none later than _____

Signed in triplicate this _____ day of _____, 19____

Witness:

(Signature of purchaser)

Approved at _____, _____, 19____

(Signature of approving officer)

(Title)

SPECIAL CONTRACT CLAUSES

The following conditions and requirements constitute a part of the agreement attached hereto:

1. Trees growing upon valid claims, and trees under other contracts are not included in this sale.
2. No trees will be cut until paid for, or removed from the place agreed upon for counting until counted by the forest officer. Title to all trees included in this sale will remain in the United States until they have been paid for and counted.
3. Trees purchased shall be piled or baled for count at such places and in the manner prescribed by the forest officer.
4. The purchaser and his employees will do all in their power to prevent and suppress forest fires; will dispose of slash and other refuse as instructed by forest officers or in the manner herein provided; shall pay the United States for any damage resulting from his operations on this sale, and shall repair all damage to Forest Service roads, trails, fences, ditches, and telephone lines resulting from operations conducted under this sale.
5. All tree stubs shall be cut not over 16" from the ground. The stump and long butt shall be trimmed of all branches at the time the trees are cut.
6. All trees cut shall be paid for at the herein prescribed rates, except that charges for trees not conforming to the market specifications for Christmas trees may be waived by the Forest Service, provided, that in the judgment of the forest officer, the ratio of such unmarketable trees to the total trees cut is not excessive and that the cutting thereof was not the result of carelessness, indifference or unskilled workmanship on the part of the purchaser or his employees. For the purpose of this waiver, it is mutually agreed that more than five percent of the total trees cut shall not be included in any waiver of charges under this agreement.
7. No tree shall be cut which is more than eight feet from the nearest other coniferous tree of any size.
8. Christmas trees cut from this sale will be kept separate from trees cut from other sales or from private or State land until counted.
9. No tree more than _____ feet in height shall be cut unless specifically designated by the forest officer, and no tree over _____ inches in diameter four and one-half feet from the ground shall be cut unless _____ percent of the total length is utilized as a Christmas tree.
10. The decision of the Secretary of Agriculture shall be final in the interpretation of the regulations and provisions governing the sale, cutting and removal of the trees covered by this agreement.
11. All operations on the sale area, including the removal of trees, may be suspended by the forest officer in charge, in writing, if the conditions and requirements contained in this agreement are not performed; and failure to comply with any one of said conditions and requirements shall be cause for the termination of this agreement.

(over)

12. No member of or delegate to Congress, or resident commissioner, after his election or appointment, and either before or after he has qualified, and during his continuance in office, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however, herein contained shall be construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company, (Section 3741, Revised Statutes, U.S.C., p. 1310, Section 22 and Sections 114-116, Act of March 4, 1909, U.S.C., p. 475, Sections 204-206.)

13. This agreement will not be assigned in whole or in part,

14. The conditions of the sale are completely set forth in this agreement, and none of its terms can be varied or modified except in writing by the forest officer approving the agreement, or his successor or superior officer, and in accordance with the regulations of the Secretary of Agriculture. No other forest officer has been or will be given authority for this purpose.

15. All moneys paid under this agreement shall, upon failure on the part of the purchaser to fulfill all and singular the conditions and requirements herein set forth or made a part hereof, be retained by the United States to be applied as far as may be to the satisfaction of the purchaser's obligations hereunder.

16. Neither the purchaser nor any contractor, subcontractor, agent or employee of the purchaser shall discriminate, in the performance of this agreement, against any person on the ground of race, creed, color or national origin.

LIST OF CHRISTMAS TREE COMPANIES AND SHIPPERS

LARGEST CHRISTMAS TREE SHIPPERS AND COMPANIES
OPERATING IN WESTERN MONTANA IN 1947

Listed below are the largest shippers and companies which operated
in Western Montana in 1947.

CHRISTMAS TREE COMPANIES

J. Hofert Co.	Seattle, Washington
G. R. Kirk Co.	Los Angeles, California
Western Tree Co.	Mason City, Iowa
Michael Seed Co.	Des Moines, Iowa
Montana Evergreen Co.	Kalispell, Montana
Cus Relias	Eureka, Montana
J. Navillio	Eureka, Montana
A. J. Thomas Co.	Kalispell, Montana

SHIPPERS

T. Mannheim	Kalispell, Montana
Sephus Anderson	Kalispell, Montana
H. Winkley	Kalispell, Montana
H. Walters	Kalispell, Montana
Chris West	Darby, Montana