Preface

Aside from fulfilling a requirement towards obtaining a bachelors degree in Technical Forestry, this thesis purports to set out in concise form the economical possibilities of Christmas Tree Production.

Acknowledgement is gratefully due the following who have contributed information used in organizing the report: Forest Service Officers, Experiment Station Superintendents, Christmas Tree Dealers, and Oregon State College Instructors.
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INTRODUCTION

Yule-tide spirit is a deep-seated emotion universal amongst all civilized peoples. Christmas bells ring out joy and happiness to all during the "grand finale" of the year. At this time, friends and relatives everywhere join in various Yule-tide activities. Gifts are exchanged; friendships are renewed; fun and frolic are evidenced in all habitations. Christmas trees and evergreen decorations are symbolic emblems of all these celebrities. It will be of interest at this time to trace the history of this extensive practice.

History

The custom of providing evergreen ornaments, during the Yule-tide holidays, began to spread throughout the world about 130 years ago. Just when and where the Christmas tree idea originated is not definitely known; but various sources have been given, some of which date back to the ancient Egyptians, and some of which link to Scandinavian mythology.

From pagan times, the tree has formed a significant part of many festivals. The ancient Egyptians, in winter, decorated their homes with the fronds of the date palm which to them stood for eternal life and heaven. The Romans used the pine trees decorated with images of Bacchus during their Saturnalia.

An often spoken of source from which the Christmas tree idea may have evolved is Yggdrasil, the gigantic evergreen tree of Scandinavian mythology, which was supposed to have sprung from the center of the earth. In its branches were the dwelling places of gods and men; giants and dwarfs. Among its foliage a stag browsed inces-
santly on the sheaves of time. Four other stags consumed the buds symbolizing the four seasons consuming the hours and the days. High up in the tip the sun-eagle had his nest. Other animals represented other wonders of the world. The gold and silver balls and gay toys hung on the Christmas trees today are the relics of the symbols of the sun and the moon as well as of the stars and other characters that were associated with this mythological tree.

An English legend has it that Saint Winfred, the missionary of Charles the conqueror of Saxony, is credited with introducing the Christmas tree idea. Winfred, destined to be sacrificed to Thor of the Hammer, was freed by his woodsman friend Aske who in turn had recently witnessed the relief for his daughter's fever illness by the prayers and soothing influence of the missionary. After the missionary had thus been released from his doom and, now, having been further strengthened in his convictions; he proceeded to cut the sacred oak consecrated to the Saxon god. At the moment, a violent wind came and crashed the tree to the ground shattering it into four pieces, one falling in each direction. Directly in its path stood a young fir its tip pointing straight to heaven. The fir was so miraculously saved that Saint Winfred proclaimed it a token of eternal life for its leaves are green at all times of the year. Because it pointed to heaven he called it the tree of the Christ Child. The people gathered about it rejoicing; and Winfred bade each man take a small fir tree and place it in the center of his home where it should shelter nothing but living gifts.

In the Rhine valley, Martin Luther introduced the practice
about 1600; and the legend of his sons first Christmas tree is probably the most authentic source responsible for the modern practice. As the story goes, Luther was out walking one clear star-lit Christmas eve; so impressed was he with the beauty of the night that he conceived the idea of decorating an evergreen tree for his small son covering it with candles to represent the twinkling stars and the story of Christ. Almost 200 years passed and only the children of the Rhine valley knew the delight of having "Yule-trees." In about 1800, however, the custom spread to various parts of Germany and from there all over the world. Today, the use of Christmas trees and evergreen decorations symbolic of this world wide Yule-tide spirit has given rise to a new forestry enterprise.
THE CHRISTMAS TREE BUSINESS

Scope

As an enterprise it may be an independent or dependent organization having as its purpose the production of Yule-tide greens, either handled as a Christmas tree plantation, or as a part of our National forests. Handled as in the former, the business may be a Christmas tree industry in its entirety including the growing of the living and cut trees of the desired species; and the manufacture of evergreen wreaths, streamers, sprays, and other such Yule-tide products. On the other hand, it may be a supplementary enterprise. It may be a small plantation on a farm producing an annual crop and sold on the counter of a general produce store.

Expansion

The nature of the enterprise negatives any vast expansion in future markets. The relatively short life of the biggest part of the products and the characteristic traditional use inhibits any voluminous increase in the production of materials. In lieu of the dubious possibilities of big expansions, there will, however, always be a certain annual demand for these Yule-tide products.

Consumption

The annual consumption of cut trees over the civilized nations has been roughly estimated at one tree for every twenty people. This waste figure was determined in consideration of trespass; and it does not include materials used for other evergreen decorations.
Increase in Production

Moreover, an increase over the present production can be experienced by preventing any trespass and by encouraging the use of more evergreen decorations in the form of wreaths, garlands, and other "made-up" decorative furnishings. Higher prices can be enjoyed from cut Christmas trees if more attention be given to the selection of the trees that are to go on the market. The scope of the industry is elevated by the sale of the so-called fancy priced trees. In 1930 two such "big" trees, one occupying the "City of Paris" in San Francisco and the second placed in Schlesingers in Oakland, were purchased for four hundred dollars ($400.00) each, delivered. The stores erected the trees; and the dealer "plugged in" any broken branches and sprayed the trees.

Better allocation of sources, in so far as elimination of losses due to long shipments and over supply of trees are concerned, will be indicative of more profit to those primarily interested.

Further development of Yule-tide forestry as a subordinate use of land where some other dominant use prevails will mean more of tangible and intangible assets.

Stimulating the demand for more manufactured Yule-tide decorations affected by advertising the vast assortment of such products that have as yet not been introduced into many localities and extending the industry by elaborating on the present uses; a small phase of the industry, profitable as it is at the present where established, can be increased considerably. An innumeration of these products would include: garlands, sprays, spray baskets, candlesticks, roping, ground evergreens, wreaths, hampers, and other forms. Inci-
dental to this list of manufactured products, other articles sold in
loose form would include: pine cones for the fire place or for de-
corative purposes, balsam needles for burning or pillow making, bril-
lant colored berries of the varieties of holly, bittersweet, bayber-
rries, and others used for ornamentals. Price lists of different
Christmas tree dealers show that wreaths are selling for $1 up to
$10 each depending on the design and size. Fancy door sprays sell
for $25 and upwards. Balsam roping sells for $.50 per yard in the
east in proximity of balsam forests. Balsam needles are even sell-
ing for $.50 per pound in the balsam fir region.

As it is undertaken at the present time, this phase of the in-
dustry would be most profitably handled by forest nurseries, floral
shops, and landscape architects.

In a particular Christmas tree sales area, the limbs of the
unused portion of the bole are being utilized in the manufacture of
wreaths and garlands. The material is disposed of at $2.50 per ton.

Along with the discussions of the "made-up" Christmas tree de-
corations there should be mentioned the use of living or potted
trees. Many people prefer living trees because they want to set
them out after the holidays. So-called baby Christmas trees are
coming into use more and more; and they make a thoughtful gift for
an invalid or a "shut-in". These are often handsomely decorated
with cones and red berries and are set in white birch standards.
Correspondingly, they command a high price.

The bulk of the industry, however, will be centered on the
production of cut Christmas trees; and regulation will necessarily
be concerned with supplying the most desirable tree at the smallest cost. This can be accomplished by dedicating Christmas tree sales areas within our National forests located in reference to habitation of the species and nearness to population. To supplement this source there should be established Christmas tree plantations so located to meet the demand in regions devoid of any of the suitable species. Proper allocation of these sources over a region, as for example, over the United States would make possible the production of highly satisfactory Christmas trees at a fair price. It would also eliminate a large amount of the waste. Moreover, a better product at a lower price will increase the present demand and will discourage trespass. Before we begin the discussions of the development of these two sources, we should have clearly in mind the types of trees to grow. In other words, we should answer this question: What are the desirable characteristics of a Christmas tree?
THE CHRISTMAS TREE

Specifications

1. The tree must not have any "miss" spots in the whorl of branches.

2. The internode must not be greater than 9 inches and not greater than 5 inches in the 1-3 foot height class.

3. The limbs should display an evenness from all sides which will give it symmetry of form. The dealers find difficulty in selling trees that may have symmetry on one side even though such trees could be used satisfactorily for "corner" trees.

4. It should have a dense crown of foliage.

5. Crooked stems are a defect; and such trees are unmerchantable unless the foliage is so dense that it will hide the crook.

6. Striking blue color and fragrant foliage, though not essential characteristics, are very desirable.

7. Branches must possess sufficient stiffness to hold decoration.

8. It must be retentive of its foliage for a reasonable time of the holiday season when brought into a warm room.

Species

The spruces and true firs combine many of these qualities; and at the same time, many of these, the firs especially, are often inferior for saw timber and in many localities are not satisfactorily located in regards to water supply to be used for pulp wood production. Other good trees are: Douglas Fir, the true cedars, the sequoias, and others of the cedar-like group.
Red Fir (Abies magnifica), a species very satisfactory for Christmas Trees.
Red Fir (Abies magnifica) found in the high Sierras grows to be a large and stately tree. However, it is inferior for saw timber and is not satisfactorily located to be used for pulp wood production. Consequently the smaller trees seen in the picture are the most valuable.
Prices

Poor selection of trees in the past disregarding the essential characteristics listed above has been the principle reason for the low prices.

In 1926, there were 260 cars of Christmas trees with an average of 3000 trees per car shipped out from western Washington. These were shipped principally to the southern states; and the sales netted the state of Washington an average price of $.30 per tree. Trees were sold from the Manzano National Forest, in 1930, for $.25 per tree when they were taken from a central depository. In comparison with these figures, the Eldorado National Forest, where more care is administered in the selection and classification of the trees, is selling them for the prices listed below:

$ .05 for the class 1-3 feet,
.25 for the class 4-10 feet,
.50 for the class 11-15 feet,
1.00 for the class 16-25 feet,
5.00 for the class 26- upwards.
CHRISTMAS TREE SALES AREA

Location

The principle sources of the wild trees of the species of concern are in the following regions: Pacific Northwest, northern part of the Lake States, northern New England and New York. Within these regions Christmas tree sales areas could be located in regards to the following factors: nearness to a large enough market to warrant dedication of sizable sales areas, and accessibility of the area by truck and automobile transportation.

As a convenience for the public the sales area should be easily accessible by car. Many people, traditionally or otherwise, want to go to the forest to select their own trees. Just as good roads and improvements are desired by the public so these Christmas tree sales areas are a means of obtaining the goodwill of the taxpayer. The additional arrangements and extra supervision necessary, if these conveniences are provided, are warranted. The success of such an arrangement is seen in the following example. On the sales area of the Manzano National Forest, New Mexico, where this feature has been instigated, there is much hilarity and Yuletide enthusiasm evidenced during the last few days before Christmas. On a specific date, Sunday, December 22, 1929, there were over a thousand people thus starting their Christmas festivities.

Area

The size of the areas must be determined by the markets of the region. As has been indicated, long shipments should be avoided. Managed on a sustained yield basis, concerned with the number of
Red Fir thickets on the Eldorado Christmas Tree Sales Area

Grazing in the Red Fir region is not incompatible with Christmas tree production as there is very little consumable forage within the thickets.
suitably formed Christmas trees, there will be as many acres required as can produce this annual demand.

Theoretically, an acre stocked with even-aged trees of the same species spaced 4 by 4 feet will produce about 2720 trees of the height class most commonly sold. For Christmas tree production this might be considered as an index of normality. After having obtained a cruise of the area, this index of normality can be applied to the cruise data in determining the necessary size. Site variations will effect the rotation age but not the spacing required for the form quality of the trees.

Regulation

The Christmas tree working circle provides for a sustained yield of the desirably formed trees on a short rotation basis. The rotation should be approximately 10 years with an annual cutting cycle. Variations in the rotation age will depend on the species and the site quality. Differences will not be material and generally speaking the bulk of the trees can be grown within this rotation. This takes into consideration the time necessary for regeneration and establishment of the young trees. As has been referred to previously, the 4-10 foot height class includes the trees most commonly in demand; and for the true firs and the spruces 10 years is the average time required to reach this height.

Thinning System

A modification of the thinning practice known as the Borggreve method most clearly defines the procedure of the cutting operations. By this method the upper crown classes are taken out first thus re-
leasing the lower classes. This provides for free development of the portion of the tree that will make a Christmas tree. Generally the crowded individuals when released by thinnings will develop trees of suitable form and size in less than 10 years. Consequently such suppressed and deformed trees can be handled so as to furnish an adequate supply for the other tree height classes. Otherwise, crown improvement or release thinnings can be practiced to prevent any dearth of any of the tree height classes for which there is a demand. In a concluding statement, the cutting practice involves two purposes: fundamentally, the procuring of a saleable Christmas tree, and secondarily, providing release for the succeeding crops.

**Marking**

So far, very little work has been done in developing the mechanics of the job of marking. However, the discussions here should bring out some useful hints. The strip method by which one marker would precede the other so as to give the accompanying marker a guide by which to mark to, probably, is the most efficient method of covering the area. Marking of the trees can be done best by attaching a strip of red cambric cloth to the tree to be cut, preferably at the tip of the branch about eye-high. Incidentally, if the marking strips are counted and tied in bundles of fifty or some such convenient number, the markers can keep track of the trees marked per day. The average number of trees marked per day per man will be about 400. The average cost will be about $0.025 per tree. Markers should be instructed to mark conservatively, as often, doubtful trees when marked and cut reveal "miss" spots and are, then of course, valueless.
Marking the trees that are to be cut for Christmas trees.
Cutting Practice

From past experiences, it is evident that cutting must be done by men hired by the Forest Service. The idea of letting the purchase cut his own trees has caused considerable grief from the supervision standpoint. Poor utilization has also resulted; and it has not been adopted to mass production.

Local men can be hired provided they are familiar with the woods and the use of the axe. Employment furnished at this time of the year is quite a help in many localities where Christmas tree areas are located.

Often the Christmas tree comes from the top portion of the felled tree. Therefore stipulations must be set in regards the allowable stump height as well as disposal of the brush and the unused portion of the trees. Trimming and piling of the brush has been practiced on one sales area. These piles are in the open as nearly as possible in order that decay will more rapidly effect their disposal. Considerable difference of opinion in regards this factor of forest sanitation has been evidenced; and a definite statement cannot be formulated as to the feasible method of handling this accumulation of slash.

The Christmas trees must be packed or hauled to a road or loading place designated by the Forest officer in charge of the cutters. In undeveloped areas long hauls to the loading place are objectionable; and cutters will either leave large numbers of marked trees at the most distant areas or cut mainly the smaller and lighter trees. There are two possible means of remedying this difficulty, either by building more roads or contracting for a party with sled
Trimming and piling of the unused portion of the bole
and horses or other such convenient means to pick up trees wherever they happen to be felled and, then, transporting them to the loading place. Obviously, the former method holds preference. Where the topography is relatively smooth, mere ways suitable for small trucks will be adequate.

Three-men crews seem to be the best arrangement for cutting when one of the crew saws off the Christmas tree and does the trimming and piling while the other two fell the tree and haul it to the loading. At 10 cents per tree cut, the average daily wage will run about $5.00 per man.

Counting

Counting of the trees cut is most advantageously done at the place of loading, and should be done by the Forest officer. Simultaneously, they can be graded as to height classes, tagged, and recorded. A check on the cutters can be had by assigning a number to each crew thus facilitating the keeping of records since each tree would then be marked by the cutter. Tagging of the trees that go out is an affective means of advertising.

Transportation

From the loading-place to the marker or shipping point, the motor truck furnishes the most economical means; and the proposed location of the areas making possible truck transportation was made in concern of this vital factor. Smaller trucks can be used to bring trees over subordinate roads or ways, according to the topography, to the highway where the transport freighters can continue
Loading place from which the trees are hauled by small trucks to a highway.
There are over a thousand trees on this freighter.

Christmas trees on the way to urban centers to play their part in Yule-tide festivities.
the haul to the market. As high as 1000 trees can be hauled on these transport trucks without injury to the trees.

Storage

Storage in many localities is undertaken for a period of over a month. Inaccessibility of the area due to early snowfall, and convenience to the purchasers necessitates the providing for storage. Storage in the open is successful provided the trees are given some attention and not piled so close together that "sweating" will take place. Stored in the open this way at high elevations of 2000 to 3000 feet above sea level the trees can either be placed in sheds or barns or planted in the shade.

The system of storing trees in cold storage plants is much more efficient. In most cases the loss due to drying-out in storage when handled this way has been reduced to nearly 2%. Moreover, the storage period can be extended much longer with these facilities. In some regions, Christmas tree cutting begins in late September. Any storage service where a temperature of from 30-40 degrees F. is maintained will prove satisfactory.

Costs

The administrative costs have already been referred to in the discussions of the different operations. The costs per tree are summarized below.

<table>
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<tr>
<th>Working</th>
<th>Counting</th>
<th>Supervision</th>
<th>Total</th>
</tr>
</thead>
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<tr>
<td>$.025</td>
<td>$.013</td>
<td>$.015</td>
<td>$.053</td>
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</table>

The tabulated figures are a record of the costs for the 1930
season on the Eldorado National Forest. These figures check the 1929 results very well; and the Forest officers of the Eldorado are of the opinion that the administrative costs will not vary materially from the above. For practical purposes they afford average figures of the administrative costs.

Operating costs will include the following expenses: loading, unloading, transportation, storage, selling costs, cutting, and overhead. The loading charge consists of two items: loading of the small trucks on the sales area, and loading of the large trucks at the main highway. The unloading charge is made up of two items: unloading at the highway, and unloading at the storage plant. The transportation charge is made up of hauling of the trees by the small trucks to the highway and hauling from this point to the market. The storage charge consists of the costs of holding the trees in cold storage. The selling cost includes: handling charges in storing at the time the trees are placed on the market, delivering trees, and all attendant expense involved in soliciting and taking orders. The cutting costs have already been dealt with, and no further explanation. The overhead charge consists of: all the expenses incurred by the permittees in conducting negotiations, supervision of transportation, and of the conducting of a central office for doing of business.

Besides the above listed operating costs, losses incurred from drying-out of the trees left in storage and for trees left in the hands of the dealers must be figured. A study of these losses on a sales area over 3 seasons indicated that a waste figure of 20%, presents a maximum allowance. Similarly, the margin for profit and risk was determined; and a 30% margin figure should take care of the
unusual features involved.

Below are tabulated the operating costs as listed above.

These figures have been compiled from record costs of the Eldorado National Forest for the last season.

Loading - - - - - - $0.018
Unloading - - - - - - .012

Transport

Small trucks - - - - .024
Large trucks - - - - .100

Storage - - - - - - .180
Selling cost - - - - .210
Cutting - - - - - - .150
Overhead - - - - - - .120

Total costs $0.814

Prices

Selling prices for the different tree height classes have been averaged from prices obtained by San Francisco and East Bay Region dealers. The weighted values have been computed from percentage figures of the cut per height class from the Eldorado. The computations determining the average selling price per tree are tabulated below.

<table>
<thead>
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<th>Tree class:</th>
<th>Price per tree:</th>
<th>% cut:</th>
<th>Weighted value</th>
</tr>
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<tr>
<td>1-3</td>
<td>$00.81</td>
<td>51.9</td>
<td>$0.420</td>
</tr>
<tr>
<td>4-10</td>
<td>3.75</td>
<td>46.1</td>
<td>1.729</td>
</tr>
<tr>
<td>11-15</td>
<td>9.375</td>
<td>1.8</td>
<td>0.169</td>
</tr>
<tr>
<td>16-25</td>
<td>25.00</td>
<td>0.2</td>
<td>0.050</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2.358</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reduced by 20% waste .474

Aver. selling price/tree $1.894
Indicated Stumpage Margin

Average selling price $1.894
Total operating cost 0.814
Total margin $1.080
Margin for profit and risk at 30% -0.294
Indicated margin $0.786

On several sales areas the average value per tree is far below the indicated stumpage margin; but Forest officers, undoubtedly, are justified in selling the trees at below margin costs because of the additional benefits, particularly silvicultural benefits. Other benefits such as furnishing employment and providing for better protection of the area may enter in. Moreover, the Christmas tree business is the sole source of revenue from some areas. The Red Fir (Abies magnifica) stands, on the Eldorado, to which reference has been made frequently, did not yield any revenue prior to the establishment of the Christmas tree sales area. Now, on a 600 acre tract dedicated to Christmas tree production, an average of $3.00 per acre per year is yielded.
CHRISTMAS TREE PLANTATIONS

Location

Christmas tree sources supplementing the sales areas as referred to in the previous paragraphs should be established in thickly populated areas distant from any wild stands of the Christmas tree species. Broadly speaking, these plantations would be most profitably located if established in the Central Plains Region and in the Southern States. At the present time, most of the demand in these regions is being supplied from forests of the north and west by shipping in carload lots of tightly packed trees. Most of these trees have been cut weeks and even months before the holidays and consequently have poor lasting qualities. When shipped from such distant sources they generally lose their foliage as soon as taken into a warm room.

Other allocating factors are: distances to large cities, site conditions, and protection. A plantation located within truck hauling distance of a large town or city and remote from an extensive supply of wild trees would appear to be well situated as far as markets are concerned. In regards site, almost any soil of good texture will grow conifers; but best success is achieved where the extremes of course sands and heavy clays are avoided. Swampy soils are also undesirable. Land that can be cultivated should be selected if the plantation is going to be permanent. Concerning the protection factor, the chief destructive forces are: fire, insects, fungous diseases, and livestock. These must be guarded against. On plantations where cultivations are not going to be continued and where such plantations are grown in conjunction with timber produc-
tion, the fire hazard may be high. In a grazing region, fencing must be resorted to in order to protect the plantation. Insect and fungous diseases cannot be completely excluded; but selection of pest-free species and practicing forest sanitation are feasible, and practicable measures of protection.

Trees to Plant

The following are some of the species suitable for cultivated Christmas tree production: Norway Spruce (Picea excelsa), Blue Spruce (Picea pungens), White Spruce (Picea glauca), White Fir (Abies concolor), Balsam Fir (Abies balsamea), Deodar (Cedrus deodora), Douglas Fir (Pseudotsuga taxifolia), Eastern Red Cedar (Juniperus virginiana), and others.

Taking all factors into consideration, the Norway Spruce is to be recommended over the others listed. Blue Spruce is a slower grower but has an advantage of having a dense blue crown of foliage. White Fir is well adapted to severe climates. Balsam Fir is not successfully grown outside of its natural range. Douglas Fir is probably as desirable as Norway Spruce except for its slower growth. Deodar and Eastern Red Cedar are better adapted for warmer climates. For eastern planting when western species are to be used, the seed should be obtained from the Rocky Mountain varieties in order to insure hardiness and resistance against insects and diseases.

Planting

Planting costs and weeding expenses will be less if the plantation has been adequately prepared before planting by plowing in
the fall and discing in the spring prior to planting. 

Four by four feet spacing is to be recommended as this provides ample room for cultivation and proper development of the trees. This will allow 2,720 trees per acre.

Spring is usually the best time for planting; but fall planting is permissible if proper moisture conditions are evidenced. Transplants should be "heeled-in" if there is a delay in planting.

Watch the following points in planting: keep the root hairs moist all the time, crowding of the roots in the hole should be avoided, thoroughly tramp the soil around the roots of the young tree, and do not set the tree any deeper in the ground than it stood in the nursery.

**Cultivation**

Cultivation 3 or 4 times each summer for the first 2 years is usually sufficient. Some cultivation will be practical the third year also; but care must be exercised in not injuring the roots. After the third year, large weeds and briers which appear to be choking the tree, may be cut to advantage. Plantations may be cultivated at odd times when other work is not pressing.

Fertilization is not necessary if the soil is fairly good, but it will increase the growth of the plantation. Of course, height growth must not be stimulated if a spindly effect is thus created. A tendency of trees to turn yellow ordinarily may be corrected by application of barn-yard manure or a commercial fertilizer rich in nitrogen.
Returns to be Expected

Last year an experimental Christmas tree plantation was established in Livingstone County, New York in order to actually show the farmers the profitableness of such an undertaking as well as formulating a feasible plan of development and subsequent care. This tract is ten acres in area taken out of a recently acquired reforestation farm. It has been stocked with Norway Spruce (Picea excelsa). After the educational purpose has been accomplished, the tract will either be maintained for Christmas tree production or changed to timber growing. This experimental plantation should serve as a valuable guide and in instructive source of information for others who contemplate establishing similar plantations.

With a few basic assumptions, a relatively accurate figure can be obtained of the returns to be expected, as for example on a convenient unit, an acre. Four-year-old transplants of Norway Spruce, White Spruce, and Balsam Fir can be obtained for about $20.00 per thousand. With 4 by 4 foot spacing there would then be required 2,720 trees. The cost of planting stock would be $54.40 per acre, plus shipping charges which would depend on distance. Perhaps $65.00 for the trees delivered would be a fair charge. The cost of planting and soil preparation will vary; but should not be over $30.00 per acre. Compound interest may be figured at 6% on your investment for 7 years when the entire crop will have been removed. Neglecting taxes and interest charges on the value of land, this would be equivalent to a yearly income of $70.42 per acre.
OTHER YULE-TIDE PLANTS

Besides the species of evergreen trees mentioned in connection with the establishment of Christmas tree plantations, brief mention should be made here in order to make this report complete, of some of the other plants that say "Merry Christmas". These would include: holly, mistletoe, and poinsettia.

Holly

Especially is the holly with its brilliant red berries one of the most conspicuous features of Yule-tide as it enters colorfully into the festive spirit of the hour with its boutonniere sprigs, gay wreaths, and gift laden branches.

Botanical authorities list 175 species of holly trees distributed throughout the world. All are evergreens; though some of the European species have blackish green leaves and bear yellow or black berries. The English Holly (*Ilex aquifolia*) with its bright green leathery leaves and berries of richest scarlet are used ornamentally in the parks and gardens in England. The American Holly (*Ilex opaca*) does not have as rich colored berries nor as glossy leaves. In the bottomlands of Arkansas, Tennessee and Texas, stunted bushy growths occur; while the taller scantier-branched trees are found along the Atlantic Coast from Massachusetts to Florida.

Successful holly production is chiefly hinged on adequate knowledge of the best methods of propagation. Dr. P. W. Zimmerman of the Boyce Thompson Institute for Plant Research, at Yonkers, New York, has for several years been experimenting along these lines. American Holly (*Ilex opaca*) has been the species studied.
All laboratory details of the work will be omitted from this report; but a brief summary of the results are of concern.

1. Cuttings were best when obtained between August and December. Current years growth was used only, except new wood plus some 2-year-old wood. Three or 4 leaves were left on each cutting.

2. Equal amounts of peat, moss, and sand gave the best results for rooting. Holly is not, however, fussy about its soil. Leaf mold or a mixture of peat moss and soil are acceptable. Six inches depth was employed in which cuttings were slanted to make leaves lie flat on the soil.

3. Evergreen Hollies were grown in a green house at temperatures of 65 degrees F. to 75 degrees F. as a practical average. It requires from 3 to 4 months to get a high percentage of rootings. After about 14 weeks, when a large root system was established, the cuttings were potted. The moisture and the surrounding humidity was kept high for about 3 weeks when they may be handled in the bench in the regular way.

4. The above gives 40-80% successful holly cuttings.

5. A 2-year-old potted holly to be used for Christmas decorations should be set out in early spring or summer, otherwise, if set out after the middle of July, the first winter may prove disastrous.

_Mistletoe_

Mistletoe has been hallowed by history as has the holly and other Yule-tide greens. The traditional sentiments which for centuries have been associated with this plant in Europe were immediately invested into the American species by the early settlers.
Abnormal growth due to Mistletoe
The European forms are not identical with the American forms; but they resemble each other so much that the first Americans supposed them to be the same. Thus, the great majority of people think of the mistletoe in terms of this traditional sentiment and, of course, do not realize that it is a pest which causes great damage to trees in some sections of the country.

The mistletoes occurring in the United States belong in two genera of the family, Loranthaceae, namely: Phoradendron and Razoumofskya. The former genera is of importance because of its large green leafy forms. It is also widely distributed over the United States living on a large number of hardwood trees.

Because of the serious injury that these parasites cause, their eradication should be encouraged; whether or not they are used for Christmas decorations.

**Poinsettia**

This shrub belongs to the spurge or Euphorbia family. It was first introduced to the United States by Dr. Robert Poinsett, a distinguished diplomat. While in South America acting as a U. S. Commissioner, he became very much attracted by this native shrub there and on his return to the United States brought some of the plants with him. Today, they are quite plentiful and play an important part in the colorful scheme of the Yule-tide decorations. The plants can be grown successfully under cultivation without any difficulty and should be included with the other Yule-tide varieties and species.
CHRISTMAS TREE MARKET

Up until very recently, little thought or attention has been given to Christmas tree merchandising. Mention has been made of central depositories on the Christmas tree sales areas, as proving very successful.

These Christmas tree yards, as they might be called, are erected of several rows of posts 10 feet apart. Two strands of wire at the top are stretched across these posts. The trees are set between the bottom wires and temporarily wired at the top thus enabling the people to circulate thru the area. This allows the customers to view the trees from all angles while at the same time not causing any damage by tramping or by handling the trees.

Similar display yards can be set up on vacant lots in cities. Temporary standards can be used instead of wire supports. Trees displayed should be arranged according to the proposed tree height classification in order to standardise prices.

Community and business firm trees are generally prepared and erected by Christmas tree dealers. Even though unusual precautions are taken in falling the bigger trees, there is apt to be some breakages. Besides, it is the exception rather than the rule to find a tree that is devoid of "miss" spots. Dealers can do this phase of the work to profitable advantage.
CHRISTMAS TREE PRODUCTION AS A SECONDARY USAGE

On some Christmas tree sales areas and on some experimental forests, Christmas tree cutting is simultaneously a silvicultural improvement thinning. On these areas, betterment of the stand towards more timber production per acre is the principle objective. With a better knowledge of the essential characteristics of a Christmas tree, a large amount of this otherwise slash material can be utilized.

On farmer's woodlots where fuel wood and fence posts are grown, Christmas trees, interspaced, will net the owner an early income as well as afford protection of the soil and keep out undesirable vegetation.

In the plains regions where forestry includes windbreaks and shelterbelts, Christmas tree production can profitably be managed along with the primary use of the plantation. Growing conditions are particularly adverse for trees on many of these plains. However, many of the spruces referred to in this report can be grown there successfully. Moreover, an interesting fact has been revealed at the Great Plains Experiment Station, located at Mandan, North Dakota, in regards to afforestation with Douglas Fir. Present indications are that it can be grown there very satisfactorily. Much slower growth is, of course, evidenced but the resulting compactness of the crown and foliage is a decided advantage for shelterbelt purposes as well as for Christmas tree production.

In other instances, Christmas tree plantings are serving a dual purpose, particularly, in regards soil erosion. In the state
European Spruce (Picea excelsa) growing on a farm in North Dakota for windbreak. There is no reason why Christmas trees couldn't be interspaced here to profitable advantage.
of Florida, boy scouts and similar groups are cooperating with state departments so that the boys are reaping a direct income from selling Christmas trees taken from such areas while the state is being benefited by the protection afforded against erosion.
CONCLUSIONS

In conclusion, it may be stated that advances have been made recently in this phase of forestry. In regards the Christmas tree sales areas, there are many features which need further trial before any definite recommendations can be formulated. An attempt has been made, however, to bring out the facts regarding the success of the enterprise. In regards to the Christmas tree plantations, much will be determined in the future from the work that has been started by the Christmas Tree Experiment Plantation project in New York.

The history of the Christmas tree was traced in order to bring out the permanence and universality of this Yule-tide custom amongst all civilized peoples.

With the proper location of the two proposed Christmas tree sources supplementing each other in supplying the annual demand, the biggest proportion of the present waste and loss from desiccation can be eliminated.

It has been pointed out that higher income can be enjoyed if more care is exercised in the selection of the trees that are put on the market. The specifications of a Christmas tree were listed to bring out the essential features of a desirable tree.

Trespass should be discouraged and effectively eliminated by proper legislation and law enforcement. The state of Washington has initiated such legislation and exercise enforcement of a dollar penalty per tree against the convicted trespasser.

Christmas tree production in conjunction with other land uses wherever possible means closer utilization. In the wild forest areas, this fact is evidenced chiefly in improvement thinnings. On plan-
tations, it can be made possible by interspacing Christmas tree species in with the principal tree crop.

Success in the enterprise will depend on various factors, chief of which are probably: market advantages, favorableness of the site, possibilities of improvement and profitable management, species grown and class of product offered for sale, and lastly, the accomplishments of the merchandising scheme.

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