

PLANTING HANDBOOK

Region 8

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INTRODUCTION

The National Forest Manual remains the primary instructions as to planting procedure and policies. This handbook contains supplementary planting and nursery instructions applicable to Region 8 that are not discussed in sufficient detail in the National Forest Manual.

The instructions contained in the following pages apply only to the establishment of forest plantations, not to planting for road bank stabilization or in connection with recreational developments.

It is recognized that planting procedure may be revised in the light of experience gained from field observations and experiments. As present practices become obsolete, amendments to this handbook will be issued. Suggestions are desired for additions or changes which might be incorporated to improve the present procedures.

All phases of nursery and planting work are responsibilities of the Supervisor, subject to direction, correlation and inspection from the Regional Office.

REGIONAL PLANTING POLICY

Planting Objectives

Planting objectives are threefold: soil conservation, watershed protection, and timber production. The primary planting objective for the Coastal Plains Forests is timber production; elsewhere in the Region the primary objectives are watershed and soil conservation. While plantations may be established primarily for watershed protection and soil conservation, they should also produce merchantable material through the proper selection of species and spacing. The potential plantable land in the Region consists of cut-over forest land, old fields and burns. Every acre of such land will not be planted because proper land use management requires small areas of such land for other purposes than timber production, i. e., openings for wildlife, pasturage for domestic stock, or recreational use.

Planting Policy

The National Forest Manual (page 129-S) states: "The policy is to add to the timber-growing area first, and to postpone planting to improve forests already established or to hasten slightly the time when an area will be completely stocked. This policy does not apply to work to be done on timber sale areas under the provisions of the Knutson-Vandenberg Act....."

Application of this policy in Region 8 will normally exclude from planting programs areas which are now stocked 50% or better with desirable reproduction, saplings or poles of any desirable species of tree growth, and such areas where stocking is less than 50%, but with sufficient seed trees of a desirable species to effect restocking.

Status of Lands to be Planted

Only lands of National Forest status will be planted.

Planting Sites

Planting of eroding lands will be given first priority; otherwise, in planning planting programs the following factors should be the guides: productivity of site, accessibility, demonstrational value, planting costs, and prospects of success.

The more productive sites ordinarily should be planted first. This policy requires a thorough appraisal of soil and site. Full use should be made of existing soil surveys and of the understanding which can be derived from the study of stands of timber on soils of

the same classification as those which are to be planted. Conclusions must be tempered by the realization that improper farming, sheet erosion, fire and logging often impair or alter sites. Until other indicators are developed, the character and density of both high and low vegetation will be used as indexes of site quality.

Plantable areas along main traveled roads, near settlements, or other locations under frequent observation by the public, should be planted prior to lands in more remote locations, particularly if the sites are good.

Planting of areas classified as plantable, but for which a high planting cost is indicated because of location, the need for ground preparation work, or for other reasons, should be on an experimental scale until successful technique is developed and economical methods perfected.

Site Preparation

Direct preparation of the planting site, such as plowing, furrowing, hoed spots or scalping, burning, and clearing brush, is unnecessary except in erosion control or in such cases as are related hereafter.

Plowed furrows or hoed spots may be advisable on some sites where the ground cover is so luxuriant that planted seedlings are unable to compete with it during the first summer. Furrows or hoed spots should be just sufficiently deep to remove roots of existing vegetation. Hoed spots, 12 to 15 inches square, are preferred to furrows when planting longleaf pine, because the exposed soil tends to wash into the furrow and cover the bud, either killing the tree or retarding its growth.

Many old field planting sites present problems in control of soil movement which cannot be solved by a standard method. Without resorting to artificial methods, sheet erosion and incipient gullies can often be controlled by the withdrawal of old fields from cultivation, protection from fire, and the elimination or control of grazing. The larger and more active gullies will require such intensive methods that discussion must necessarily be made the subject of special project instructions. Old fields possessing a light herbaceous cover, or fields which have just been removed from cultivation, may require site preparation prior to planting to avoid losses from silting or washing.

Planting plans for projects with erosion control as a major problem will include specific recommendations for control of soil movement. Consideration will be given to type and location of check dams, bank sloping, terracing, and diversion ditches needed to accomplish the objective in the shortest practical time consistent

with cost of the work. Revegetation with grass and shrubs, in addition to forest growth, for control of soil movement will be included where such practices are considered essential.

Species

Plans should always provide for planting the species best suited to the particular site. Ordinarily this will be the species which originally grew there, provided that there have been no adverse changes of physical or ecological factors. Invariably this occurs on old fields and severe burns where sheet erosion following soil exposure has resulted in the removal of top soil and the impoverishment of the sites to such extent that they will not produce stands of the original character. It is generally accepted that hardwoods such as oaks, walnut, hickory, cherry, poplar and other broad-leaf trees will not develop into a satisfactory forest under such conditions. It is necessary to use the more hardy coniferous species for the first rotation as a means of rebuilding the site, which may be eventually occupied by other species. Hardwood plantations will be limited to favorable locations where the site has not deteriorated and ample moisture is available.

The following species are approved for Region 8 planting:

<u>State</u>	<u>Forest or Unit</u>	<u>Species</u>
Alabama	Black Warrior	Shortleaf, loblolly, black locust, black walnut, white oak, yellow poplar.
	Talladega	Longleaf, shortleaf, loblolly, black locust.
	Conecuh	Longleaf, slash, loblolly.
	Oakmulgee	Shortleaf, loblolly, black locust, longleaf.
Arkansas	Ozark	Shortleaf, black locust.
	Ouachita	Shortleaf, black locust, loblolly.
Florida	Florida N. Fs.	Longleaf, slash.
Georgia	Chattahoochee	Shortleaf, black locust, yellow poplar, white pine.
Louisiana	Kisatchie	Longleaf, slash, shortleaf, loblolly, black locust.

<u>State</u>	<u>Forest or Unit</u>	<u>Species</u>
Mississippi	Holly Springs	Shortleaf, loblolly, black locust.
	Bienville	Longleaf, loblolly, black locust, shortleaf.
	DeSoto	Longleaf, slash.
N. Carolina	Croatan	Loblolly, longleaf, shortleaf.
	Uharie	Loblolly, longleaf, shortleaf, black locust.
	Pisgah	White pine, yellow poplar, shortleaf pine, black locust, red spruce.
	Nantahala	White pine, yellow poplar, shortleaf, black locust, red spruce.
S. Carolina	Francis Marion	Longleaf, loblolly, slash.
	Sumter	Loblolly, shortleaf, black locust.
	Oconee	White pine, yellow poplar, shortleaf, black locust.
Tennessee	Cherokee	White pine, yellow poplar, shortleaf, black locust, red spruce, pitch pine.
Texas	Texas N. Fs.	Shortleaf, loblolly, black locust, longleaf, slash.

Black locust will be planted for erosion control only. Cypress, juniper, ash, the oaks and many other species may be used in experimental plantations, with the approval of the Regional Office.

Planting Stock

Age Class of Planting Stock

The following age classes of nursery stock are to be used in the establishment of forest plantations:

<u>Species</u>	<u>Age Classes</u>
Longleaf pine	1-0
Slash pine	1-0
Loblolly pine	1-0
Shortleaf pine	1-0, 1-1, 2-0
Black locust	1-0
Hardwoods	1-0
White pine	2-1, 1-1, 1-2, 2-0
Red spruce	2-1, 3-0, 2-2

Nursery Grown Stock, Wildings, and Grades

As a general rule, nursery grown stock will be used in the establishment of plantations. The use of wildings is recommended for large-scale planting only where past experience has indicated a high degree of success with reasonable cost.

Planting stock grown in the nursery does not reach uniform development in the nursery seed beds and may be separated into grades on the basis of its development. Experimental evidence indicates that best results are attained on poor sites when the highest grade of nursery stock is used; on favorable sites the difference is not so marked. Ordinarily, stock will not be separated into various grades when it is made ready for shipping unless satisfactory results cannot be obtained otherwise.

Procurement of Planting Stock

The nurseries have the definite job of producing planting stock of proper seed source, species and age class to meet the requirements of the several planting projects in the Region. Nursery production plans are reviewed by the Regional Office in order to coordinate nursery production with stock requirements of the several Forests. The Supervisor is responsible for providing the Regional Office with an estimate by projects of the planting stock needed a year hence.

Shortage of suitable trees at Forest Service nurseries may necessitate the purchase of stock from State or commercial nurseries. Such purchases are controlled by the Act of June 30, 1914, 38 Stat. 415, which says in part, ".....that hereafter, the Secretary of Agriculture may procure such seed, cones, and nursery stock by open

purchase without advertisements for proposals whenever, in his discretion, such method is most economical and in the public interest and when the cost thereof will not exceed \$500.00." Supervisors expecting to purchase stock should acquaint themselves with stock on hand, prices asked at nurseries in the territory, and source of seed from which stock is grown. No stock will be purchased unless seed source is known and it is satisfactory for the site on which it is to be used.

Cooperation with Other Agencies or Individuals

All requests for planting stock from other Federal bureaus, State agencies and others will be referred to the Regional Forester. Surplus planting stock may be sold as Government property under the established procedure and will be limited to exceptional cases where the entire nursery output cannot be planted by our own organization. Cooperative agreements for the production of nursery stock must be in effect when the seed is sown in the nursery.

Source of Seed

Seed source must always be correlated with the planting site. Planting is not universally successful under apparently favorable conditions, and chances for the best results decrease by planting trees grown from seed secured elsewhere than in the immediate locality of the planting site or a location similar in soil and climatic factors. Tree characteristics such as vigor, hardiness and susceptibility to climatic changes are transmitted from the parent tree. Adherence to this principle requires the nurseries to grow planting stock for specific projects. This cannot be done unless there is at hand definite and specific knowledge of the planting project needs. The information must be secured sufficiently in advance of planting to permit collection of the proper seed and production of the trees in the nursery. It is the Supervisor's responsibility to obtain definite and specific information for the projects on his Forest and to take proper steps for collection of the necessary seed. The Regional Office will approve plans and coordinate seed collection plans and programs.

Availability of seed crops or absence of certain species of seed trees in the locality in which planting is to be done often requires the substitution of nursery stock grown from seed collected outside the locality in which the planting is to be done. However, nursery stock must be produced from seed collected from trees growing in the same climatic zone.

Individual seed source records will be kept for each lot of cones collected from widely separated points. Collections made on National Forests will be further identified by the unit or ranger district. Seed from two adjacent districts may be combined, provided

elevation, soil and climatic conditions are identical and the seed lot is small. Collections from outside the National Forests will be identified by the county.

Pure and Mixed Plantations

Present and past planting practices in Region 8 have favored the use of single species in plantations: (1) the principal species planted occurs naturally in pure stands, (2) brush and intruding species provide a mixture with planted trees on most plantations, (3) simplifies the work of the planting crew, (4) uncertainty of the proper mixtures to use.

The method of mixture offering the best chances of success is to plant in groups, correlating species and sites in all instances. Mixture by alternate rows will be confined to those species having about the same rapidity of juvenile growth and degree of tolerance. Longleaf and slash pines, loblolly and shortleaf pines may be planted in alternate bands of three or more rows. This arrangement may be used on sites where the chances of successful survival and growth appear to be equal for both species, considering the effect of such factors as site, fire, diseases, insects, rodents and grazing.

Spacing

The quantity and the quality of material grown in plantations are frequently controlled by choice of spacing as much as by species planted. Past experience and present information indicate the following spacings for this Region.

<u>Species</u>	<u>Spacing</u>	<u>Number Trees per Acre</u>	<u>Remarks</u>
Longleaf & slash	6 x 6	1,210	Timber production with early thinnings for pulpwood.
	5 x 8	908	Timber production with early thinnings for pulpwood.
	7 x 7	889	Timber production with early thinnings for pulpwood.
Shortleaf & loblolly	5 x 5	1,742	Timber production with early thinnings for pulpwood; erosion control.

<u>Species</u>	<u>Spacing</u>	<u>Number Trees per Acre</u>	
Shortleaf & loblolly	6 x 6	1,210	Timber production with early thinnings for pulpwood; erosion con- trol.
	6 x 8	908	Timber production. Early thinnings prob- lematical.
	7 x 7	889	Timber production. Early thinnings prob- lematical.
Red spruce & white pine	5 x 5	1,742	Timber production with early thinnings.
	6 x 6	1,210	Timber production with early thinnings.
	6 x 8	908	Timber production without early thin- nings.

Black locust and yellow poplar - Minimum 5 x 5, Maximum 7 x 7

Black walnut - Minimum 6 x 6, Maximum 10 x 10

Season to Plant

Planting should be done when the nursery stock reaches the low point in rate of development. Height growth in southern pines sometimes continues throughout the winter, but it is usually unwise to lift nursery stock before the seedlings have been "hardened" by frost. Lack of sufficient soil moisture may result in the ground becoming so dry and hard that planting is impossible when the stock becomes dormant and must be postponed until after fall rains.

Approximate dates of the planting season are:

Appalachian Forests March 1 to April 15
 Piedmont Forests February 1 to March 31
 Ozark and Ouachita Forests February 1 to March 31
 Coastal Plain Forests November 15 to February 28

The planting job must be so planned as to utilize all favorable weather during the season. Freezing weather, saturated soils,

and droughts may interrupt the work and bring the completion of the job dangerously close to the beginning of the growing season. It is essential to plan work so as to complete the job as early in the season as possible. Trees planted early in the planting season have a higher survival and a more rapid early development than those planted later. Fall planting within the zone of frost heaving will be limited to sandy soils and those well protected by ground cover.

Protection

Planting sites subject to grazing by cattle, sheep and goats must be fenced prior to planting to prevent heavy losses the first year from browsing, trampling and pulling of the seedlings, and in subsequent years from browsing and rubbing. It is advisable to exclude stock from plantations until the trees have reached a height of from 6 to 12 feet. Woven wire fences are necessary to exclude hogs from plantations of longleaf and slash pine. Fence standards will be no higher than are needed to accomplish the purpose intended. Ordinarily, posts will not be set closer than 12 feet for woven wire fences and 15 feet for barbed wire. The latter may be supplemented by stays between posts.

Adequate maintenance of fences, fire lines and other protective measures is of high priority, and frequent checks must be made to keep losses to an acceptable minimum.

Additional precautions are necessary to protect plantations from fire. For several years, this may require supplemental patrol and lookouts during periods of high fire danger. On all Coastal Plains Forests it is necessary to construct and maintain fire lines along plantation boundaries and to traverse large plantations with interior fire lines, breaking areas into blocks of forty to one hundred and sixty acres.

Insect and rodent control will be undertaken where plantations are subject to such damage. Protective measures must be instituted in ample time to accomplish the most good. The Forest personnel must be alert at all times to signs of damage by new insects and rodents and must make a prompt report so that investigations may be initiated before the pests develop to epidemic proportions.

Rust canker is becoming prevalent on loblolly and slash pine in certain parts of the Region. Examination of plantations containing these species will include notes on the degree of infection. The Southern Forest Experiment Station and the Bureau of Plant Industry are conducting basic studies of the disease, including possible methods of control.

Planting Crew and Fires

Planting crews will not ordinarily be used for fire control. Exceptions to this rule are:

a. When a fire is reported on or near an area being planted, and one or more of the planting crews is obviously the crew for the initial attack. If the fire burns beyond the first period, the planting personnel should be replaced, if possible, by another crew.

b. In case of serious emergencies, planting crews must be called upon for fire fighting. They should, however, be replaced by other labor and returned to the planting job as soon as practicable.

c. That it may be practicable to adhere to the above, Supervisors will avoid placing "key" fire control men in nursery and planting crews whenever it is possible to exclude them.

Planting Improvements

Roads, trails, telephone lines, fences and fire lines necessary for planting will be constructed from the usual allotments for improvement activities and not from planting funds. The use of planting funds will be approved only for minor maintenance during the planting job.

Definition of "Planting Project" and "Plantation"

A planting project is an area or group of small scattered areas needing reforestation. Ordinarily, the project boundary will coincide with the ranger district or organized working circle. Each project subdivision which is planted or sown with different species, mixtures, age classes, with seed from different sources or trees grown from seed from different sources, or which is planted or sown by different methods, or which is planted at different times, will be designated as a plantation and will be given a separate number. An area planted to two species which are mixed by groups; that is, each species planted on the site or sites to which it is best suited, may be reported as one plantation even though the minor species may occupy more than the 5% limit set up by the National Forest Manual. The plantation map will show the area occupied by each species. Groups of small scattered areas such as old fields, having the same species, mixtures, age class, seed source, planting method and planting season, may be designated as one plantation; but each of the several fields will be designated by assigning it a letter; for example, P-16a, showing that it is a subdivision of Plantation 16.

Application of Section 3 of the Knutson-Vandenburg Act

The Knutson-Vandenburg Act authorizes the planting of cut-over areas where experience has shown that they cannot be expected to reproduce naturally in a reasonable length of time. In preparing timber sale agreements involving areas to be clear-cut, or containing small unstocked acreages, advantage of this Act will be taken to restock lands by planting. It is clearly within the Act to establish a more valuable stand by planting than it is practicable to obtain by natural reproduction. This principle can be applied to the conversion of scrub oak areas within a timber sale area or similar stands where a merchantable crop of timber cannot be regenerated without assistance. It is not within the authority of the Act to use the funds to finance experimental planting. Chances for success must be good, as judged by results of past efforts on similar sites. Planting with K-V funds will be included as a part of the annual planting plan for each forest.

Direct Seeding

Prior approval will be secured from the Regional Forester before direct seeding is undertaken as a part of the forest program. Until techniques are developed which insure an acceptable degree of success, trials will be limited in size and number which will yield the desired information. All plans will provide for the recording and analysis of pertinent data whereby factors effecting establishment can be evaluated.

Plantation Examination

A minimum of one reportable plantation examination is required for all plantations at the end of the third growing season. Additional examinations may be required by the Supervisor where serious losses occur four years or more after establishment. Plantations will be informally re-examined at any time if there is reason to believe that the stocking has dropped below that considered satisfactory.

Growth studies in plantations with similar site conditions, but different seed sources, are encouraged as a means of securing reliable data. These should be made as administrative studies and preserved in the permanent files.

Formal quadrat examinations are required for all plantations after the end of the third growing season as outlined below:

1. Data will be secured from a series of four quadrats having a common corner, examined at one chain interval on strips extending through the area.
2. Strips will be run at intervals of one-half mile or less, so designed to secure data from all parts of the area planted.

3. The size of each quadrat will be varied according to the spacing used in the plantation and should approximate it closely. The size of the quadrat will then correspond to the number of square feet allotted to each tree. The following table will be of assistance in determining the size of the plot to be used which corresponds to the number of trees per acre:

Size of Quadrat Feet	Square Feet	Trees Per Acre (No. Quadrats Per Acre)
10 x 10	100	436
9.5 x 9.5	90.25	483
9 x 9	81	538
8.5 x 8.5	72.25	603
8 x 8	64	680
7.5 x 7.5	56.25	775
7 x 7	49	889
6.6 x 6.6	43.56	1,000
6.5 x 6.5	42.25	1,000
6 x 6	36	1,210
5.5 x 5.5	30.25	1,440
5 x 5	25	1,742
4.5 x 4.5	20.25	2,151
4 x 4	16	2,723

4. Each quadrat will be tallied as "stocked" if it contains one or more planted or natural trees of desirable species. Hardwood reproduction of the more valuable species in all but slash pine and longleaf pine plantations may be considered as desirable. Supervisors will determine for their respective forests the species to be included.
5. Height measurements will be limited to trees which appear to be planted stock. A sample of not less than 10% should be measured and averaged as an indication of height growth. The data will be separated by species in mixed plantations.
6. Stocked quadrats will be recorded as "thrifty" or "unthrifty" depending upon the appearance of the tree found on the quadrat. Those with two or more trees will be tallied as "thrifty" or "unthrifty" according to the preponderance of evidence. Equal values will be tallied as "thrifty".

Thriftness as used above is intended to reflect the general condition of the plantation as judged by needle color, development, normal growth during the past season, relative amount of brownspot needle blight and absence of other injurious diseases or insects.

The following intensity will be observed for all plantations:

1. A minimum of 100 quadrats will be examined for each plantation.
2. Plantations of 100 acres or more will be examined at the rate of one quadrat per acre.
3. On areas where the stocking falls between 20 and 30%, strips will be run to secure a minimum of two quadrats per acre. This is intended to include only the larger blocks where fire, poor site, insects, diseases or other causes have reduced the stocking below that classed as satisfactory.

Classification of Results

A stocking of 10 - 25% of desirable species will be classed as unsatisfactory. Areas with less than 10% stocking will be classed as failures and carried as lost acreage on the records.

Replanting

Plantations with an unsatisfactory stocking and failures should be replanted if the chances for a satisfactory stand appear to be good. Careful study will be given extremely adverse sight to prevent repeated failures. Degree of stocking will be secured from a quadrat survey to determine the areas in need of replanting. Recommendations for replanting will contain a resume of causes of the initial failure and action to be taken to prevent repetition.

Experimental and Small Plantations

Plantations, regardless of size, established primarily for investigative purposes, will be classed as experimental and as such are not included in the regular forest program. The results of this work will be included in the narrative section of the annual report or in progress reports on administrative studies.

Experimental planting must be preceded by a carefully developed plan of work and procedures for the solution of definite problems. Plans will be forwarded to the Regional Forester in time for review and approval before initiation of the project. Formalized plans will be limited to those involving a large outlay of funds or require extensive and detailed examinations over a period of years. Small, informal studies of an exploratory nature may be initiated without approval of the plan of work. Form 134 may be used to record pertinent data for experimental plantations but will be designated S-STUDIES and attached to the administrative study report.

Small plantations up to five acres, not a part of a recognized project, established entirely or in part by the use of contributed time, may be classified as "unreported". Planting for landscape effects around ranger stations and public camp grounds and for roadbank stabilization will be included in this class.

Permanent Records

Plantation records will be consolidated in the supervisors' offices as outlined in National Forest Manual CA-19-3, page 19, amended November 1951. Since plantation card records are not maintained in the Region, Forms 134 for all plantations will be preserved together with the plantation maps.

PLANTING SURVEYS AND PLANS

Reforestation Atlas

The master planting plan, project plans and cumulative record of planting work will constitute the Forest Planting Atlas. It will contain the following:

1. Planting survey maps and reports.

The planting survey maps will be on a scale of 2" or 4" = 1 mile. Small areas, such as old fields, and other plantations where a large scale map is necessary, may be made on a scale of 4" = 1 mile, but will be limited to situations where the smaller map will not serve as a plantation base map. Field survey maps for projects formally approved by the Regional Forester will be submitted to the Office of Engineering. These will be reproduced and returned to the forests with the required number of prints.

2. Project and master plans.

The planting plans will follow the outline given on page 26. These will be revised at intervals of three or five years to adjust the plan to current needs and to include in the budget recent acquisitions requiring planting.

The master plan will follow the outline given for project plans, with such segregations as are necessary for a complete picture of the planting program for all units. It is a brief summary of the project plans.

3. Project planting budgets and supporting map showing areas allocated by years.

The planting budget will present in graphic and tabular form the areas and acreage to be planted annually, together with the amount of nursery stock needed, by species and age classes. Due consideration will be given to manpower, priority, accessibility, and site conditions.

4. Tabular plantation record.

The tabular plantation record will consist of a list of plantations in a given project and such information as contained on Form 134. Yearly additions to this record should be made as survival data are collected and new plantations established. In this way a ready reference is at hand from which an immediate determination of the status of plantations can be obtained without further compilation. Likewise, the record may be used as the basis for the annual planting and statistical reports.

5. Plantation maps.

Planting survey maps will be used as the base for plantation maps, adding in ink and suitable colors such data as need be shown in graphic form. This will include the following: (1) plantation numbers, (2) boundaries, (3) corner posts and numbers, (4) stake rows with number plants staked, (5) date planted, (6) spacing, and (7) species used. Such color combinations as needed will be used to show the net acres planted and to delineate plantations. One color, preferably green, will be used throughout for denoting land satisfactorily stocked and not planted.

6. Diagrammatic planting progress map ($\frac{1}{2}$ " or 1" = 1 mile).

A forest map on a scale of $\frac{1}{2}$ " or $\frac{1}{4}$ " to the mile will be used to show the progress of planting by years. This may be done by a series of colors indicating the areas completed each year.

Planting Surveys

Purpose of Survey

The aim of intensive planting survey is to assemble all data pertinent to the desirability and practicability of reforesting a given area and essential for the execution of subsequent planting plans. This, in short, is where, what and how to plant, and the cost of the established stand. These major questions should be kept in mind in securing and assembling data.

Prior to the initiation of intensive planting surveys, a preliminary examination and report will be made by qualified personnel in order to determine the extent and intensity of the detailed examination project. Existing data such as aerial pictures, forest base maps, acquisition and timber surveys will be used, supplemented by sufficient field work to determine whether conditions warrant the expense of making an intensive survey. The report should be brief and should cover the following points:

1. Description of project, source of basic information, location, and approximate gross acreage.
2. History of the area, citing reasons for present conditions.
3. Degree and quality of natural restocking. Stocking should be stated in terms of unit stocking rather than number of trees per acre, regardless of dispersion.
4. Approximate stocking of undesirable species; size, condition and effect on desirable reproduction or future planting.

5. Condition of site and its apparent ability to support a stand of timber.
6. Natural enemies such as rodents, ants, insects, and fungi.
7. Grazing situation and measures necessary to control grazing.
8. Fire history and probabilities of damage.
9. Probable cost of intensive survey.
10. Conclusions for or against further examination, with supporting reasons.

The above report is essential for areas of considerable magnitude. Small projects such as old fields and pastures which do not justify cost of both preliminary and intensive examinations will be reported on the basis of this outline, accompanied by sketch or maps of sufficient accuracy to fulfill the actual planting needs later. Where recommendations are made to plant the area, information will be added as to the species, age class, and spacing to be used, and an estimate of probable planting costs as required when reporting areas following intensive surveys.

Intensive Planting Surveys

Intensive planting surveys will be undertaken only after preliminary examination indicates the necessity for a true picture of conditions. Instructions for each project will be prepared and submitted to the Regional Forester for approval prior to initiation of the work.

General Instructions

Information obtained will be assembled in two forms - maps and supporting memoranda.

Maps - Maps will portray graphically the following information on planting areas:

1. Location of areas, including all classes. (See reproduction counts)
2. Cover conditions.
3. Soil types and conditions.
4. Species and age classes of stock.

5. Condition of areas classified as non-plantable.
6. Main topographic features, including streams, springs and main ridges. Cultural features such as roads, fire lanes, fences, buildings, cultivated fields, etc.

Collection of planting data on planting surveys should be confined to planting areas, taking into consideration the need for showing composition of adjacent and intermingled non-plantable areas. Whenever feasible, it is desirable to combine planting and timber surveys in one project, defining the objectives and stands of each type of survey in order to secure data of proper intensity.

Organization and Equipment

Responsibility for a planting survey job should be delegated to the District Ranger unless the project is a large one, when it is usually essential to delegate responsibility for the work to the forest planting chief. In either case, the Ranger or planting specialist will hold the chief of party responsible for the proper execution of all phases of the work, including maintenance of costs and such other records as are necessary. A project plan will be prepared for each job as a prerequisite to securing an allotment or approval for the project. Data collected in the preliminary examination will be the basis for the plan. The organization, personnel, and duties of each in the crew will be covered in detail. The plan will include a list of equipment needed and an estimate of the cost.

Method

Most of the forests are now supplied with forest atlas sheets on a scale of 2" = 1 mile. These will be used as survey base maps. Where forest atlas sheets are not available or the scale is clearly not suited to the conditions encountered, the facts will be presented to the Regional Office for consideration.

The object of the above is to obviate the gathering of topographic and cultural map data already in existence. By and large, topographic and cultural data on existing maps are in sufficient detail and are sufficiently accurate for planting surveys, and should be used in preference to spending additional time and effort in duplicating the information. The location of new roads, trails, fields, etc., will be noted and the elimination of obsolete data will be recorded by field parties. Due to the lack of sufficient ties between old existing land corners and topographic features when the map was compiled, some errors may be found in the location of section lines in relation to other map data. Where this has an appreciable effect on the results of the survey, adjustments may be

made as needed. Since the base map is on a relatively small scale, errors of less than five chains may be disregarded. Chiefs of party should keep in mind the opportunity to improve present map data by recording information on identified corners.

Control, where necessary, will be attained by the use of carefully run base lines, using staff compass and chain. Each primary base line will be tied to established corners at both ends. The allowable error for base line is one half chain per mile. It is preferable to parallel main topographic features with base lines in order to run strip lines perpendicular to base lines and across the topography. The distance between base lines will be not less than one and one half miles nor more than three miles.

As a means of reducing planting survey costs, full use should be made of recent acquisition and other survey property line retracings which are accurate and can be identified on the ground. Aerial pictures will be used as widely as possible to determine the extent and location of plantable lands. Boundaries of timbered areas can be identified on the photographs and transferred to the base maps. Where this is done with sufficient accuracy, no further mapping will be necessary to determine the extent of the denuded areas. Cruise strips will be run to determine the stocking.

Cruise Lines

Strip lines will be run 10 chains apart through the planting areas, except as noted. Intermingled areas which are obviously unplantable will be covered in sufficient detail to establish boundaries and obtain other necessary information. Likewise, extensive areas of obviously plantable land with uniform conditions may be covered by strips not to exceed 20 chains apart. Where frequent changes in type and site condition occur, better results are obtained with cruise strips spaced at closer intervals. Reasonable doubt as to the intensiveness of the survey should be resolved in favor of the more intensive sampling.

Mapping

Where topographic and cultural data are obtained from aerial base maps, further mapping of these features will not be necessary except to note material changes. Field sheets will be on a scale of 4" = 1 mile. Ties to base line stations, established corners, etc., will be noted. Form 493 will be used as field map sheets.

Contour intervals will not be mapped except where it is clearly evident that elevation materially affects planting plans, necessitating a detailed map to determine the limits of a given site. Where elevation is a factor, the approximate altitude of topographic features within the planting area will be used, if available, as control points.

Field map sheets will be identified by section, township and range in rectangular surveys, and by block numbers where this system is used on forests having metes and bounds surveys.

Field Data

The following are suggested as minimum standards to obtain uniform results in planting surveys. All conditions peculiar to a limited area cannot be defined herein, and where not applicable, standards will be modified to secure essential information.

Data on timber types, reproduction and soil will be secured from plots of three sizes, spaced at 4-chain intervals on cruise lines 10 chains apart, or 2-chain intervals where lines are 20 chains or more apart. The following sized plots will govern:

Timber (seed trees)	1/5-acre circular, radius 52.7 ft.
Saplings and poles	1/50-acre circular, radius 16.7 ft.
Reproduction and cover stocking	4 milacre quadrats (13.2 ft. square) subdivided in 4 plots 6.6 ft. on each side.

Timber or seed trees 8" and over DBH will be recorded by the number per 1/5-acre plot. Trees which cannot be expected to produce an appreciable amount of seed will be recorded by symbol, but will not be considered in determining the number of seed trees per acre.

Saplings are defined as trees $4\frac{1}{2}$ feet and over in height and up to 4.9 inches DBH. Saplings will be recorded by species and number of stems. Poles are defined as tree species 4.9 inches to 7.9 inches DBH and will be tallied as they occur in the 4 and 6-inch diameter classes.

Reproduction is defined as tree growth below $4\frac{1}{2}$ feet in height and seedlings over one year old. Stocking will be determined by the presence or absence of seedlings on a milacre (6.6 feet square) or its position in reference to species in the pole or merchantable sized group. A milacre is considered as stocked when one or more seedlings; saplings or merchantable sized trees are found on a plot, or if a plot falls within the crown space of a tree in the pole or merchantable sized group. Crown space is defined as the area directly beneath the canopy of the overtopping tree. This will be divided into desirable and undesirable species on the basis of the present merchantability for the site.

All three plots will have a common center which will be marked with a temporary stake for check cruising. It will be identified by blazing fore and aft on the cruise line.

Classification of Field Data

Cover types will be classified on the basis of their relation to planting job, using accepted forest types and classes supplemented by additional information on the degree of stocking all species. Due to variation in types and conditions throughout the Region, it is not practical to set up a standard legend and classification. However, the following principles will govern:

Accepted type descriptions, names and abbreviations will be used in designating forest types concerned. Variations from these will be considered only where it is clearly evident that the correct impression of the stand will not be conveyed through the conventional type description.

Four major conditions will be recognized in defining areas not established to desirable or merchantable sized forest cover which should be considered in reforestation. This will be based on forest cover previously growing on the area unless site conditions have changed so as to preclude establishment of former species. Indicate the species best adapted to the area. This will be correlated with the degree of stocking, both brush and desirable reproduction, as follows:

Previous Forest Cover:

1. Open land with less than three trees per acre of desirable species 8 inches and over DBH, less than 25 stems per acre of saplings, poles and seed trees, and not more than 25% of the milacres stocked with brush. This is divided into four classes, dependent upon the degree of stocking.

Plantable, Class I. Less than 10% of the milacres stocked.

Plantable, Class II. 11 to 24% of the milacres stocked.

Doubtful, Class III. 25 to 49% of the milacres stocked.

Non-plantable, Class IV. 50% or more of the milacres stocked with desirable seedlings.

2. Undesirable species and brush.

It frequently happens that potential planting areas carry a more or less dense stand of trees of weed species which should be given consideration in planting plans. Plantable area will be rated as follows:

Plantable, Class I. 25 to 49% of the milacres stocked with weed species.
Doubtful, Class II. 50 to 74%.
Non-plantable, Class III. 75% or more milacres stocked with weed species.

3. Saplings and poles.

This class of reproduction will be divided into two groups.

Class I. 25 to 59 stems per acre.
Class II. 60 or more stems per acre.

The number of seed trees per acre on the same area with saplings and poles will be considered on the ratio of one seed tree being equivalent to 20 saplings and poles. Class I may be considered plantable when the stands occur in groups.

4. Seed trees.

Where three or more trees of a desirable species 8 inches DBH and over, well spaced, occur per acre, the area will be classed as seed tree stands. Intermingled saplings and poles will be considered on the same ratio as given under (3).

Areas carrying minimum stands of saplings and poles and three seed trees or more per acre will be classed as seed tree areas in preference to sapling and poles.

"Desirable species" is defined as that which may be expected to reach merchantability growing under the particular site conditions under consideration. A given species may be considered as a weed or undesirable in one instance, and desirable in another, depending on site conditions.

Merchantable timber.

Stands other than seed tree areas containing 1,000 feet BM or over of merchantable sized timber will be tallied by species, diameter, number of stems, sapling and poles, on the basis of 1/5 and 1/50-acre plots. Stocking on the milacre basis will be omitted. Where timber and planting surveys are combined, project plans will define the standards to be used in collecting and recording such data.

Maps

Finished maps will define type areas as classified by stocking and cover. Although desirable, areas of merchantable timber, seed trees, saplings and poles, less than 10 acres in size, need

not be shown. Degree of stocking of reproduction need not be segregated for areas of less than forty acres.

Conventional legends and type lines will be used, supplemented by a legend showing cover type and degree of stocking on planting areas. Insofar as possible, cross hatching should not be employed in the legend, since these maps are later used as permanent plantation maps.

Alienated land will be shown, but boundary lines should not be so heavy that they cannot be removed when the land is acquired. The original map should be so prepared that additional information may be readily shown without redrafting the base map.

Project Report

The following outline will be used, adding any other pertinent project data. Copies will be prepared for the Ranger, Supervisor and Regional Forester.

1. General description of the area, including (1) name, (2) general location, (3) specific location by section, township and range, (4) area covered by survey, (5) soil description by types, (6) history of former stands, (7) present condition of cover, (8) adaptability to support tree growth, and (9) species recommended for planting.
 2. Description of climate, including amount, distribution and character of precipitation, temperatures, frosts, weather phenomena, amount and duration of snow.
 3. Need for planting, showing probable period necessary for natural regeneration to produce a forest cover adequate for its intended purpose (timber production, watershed protection, etc.).
 4. Division into working units and treatment recommended for each, based on supporting data. This is essential on large projects where manpower is a limiting factor in a given locality. Acreage scheduled for planting must be correlated with available facilities.
- Tabulated summaries of working units, showing (1) acreage of plantable land by classes, (2) requisite amount of stock by species and age classes, and (3) basis for calculations made.
5. Period to plant.
 - a. Seasonal period defining the limits.
 - b. Size of yearly program in acres and amount of stock by species.
 - c. Number of years required to do the job.

6. Probable damage by, and cost of protection from:
 - a. Rodents, insects, disease - special control measures required - cost.
 - b. Grazing of domestic stock by classes, and deer. Miles and types of fence needed.
 - c. Fire. Frequency of fire lines and construction standards. (Plat location)
 - d. Competition with ground cover and brush. Brief discussion of the probable costs of protecting plantations from each of the above classes.
7. Short description of areas not recommended for reforestation, with supporting reasons if not clearly shown on the map.
8. Organization recommended for carrying out reforestation work. Estimate of costs per year, per acre and total.
9. Organization and cost of planting survey.
 - a. Personnel and size of crew.
 - b. Year and period work was done.
 - c. Cost of survey. Cost per acre (1) per total acre covered, (2) for plantable area covered.
10. Appendix.
 - a. Copy of instructions to survey parties.
 - b. Township maps.
 - c. Table of plantable land by section and township of the area covered.

Planting Plans

With few exceptions, all of the forests have planting problems and, therefore, require concise and workable planting plans. Definite plans and local standards for the work are required, and the plans should indicate action for at least a five-year period. Revisions will be necessary as new data and technique become available, acquisition extended or other material changes occur. Planting plans will be submitted in duplicate to the Regional Forester for approval.

Forest Planting Plan

The outline below will be used in the preparation of planting plans. General planting conditions on the Forest should be discussed, but if desired, specific reference may be made to problems peculiar to certain projects or areas.

Foundation

1. Statement of size and character of the job.
 - a. Total area to be planted, classed as burns, old fields, etc.
2. Conditions that have made planting necessary.
3. Physical conditions affecting planting.
 - a. Climate.
 - b. Topography.
 - c. Soil.
 - d. Ground cover.
 - e. Brush.
 - f. Soil erosion.
4. Transportation and improvement system.
 - a. Needed additions in order of priority.
5. Objectives sought in planting. Discuss each of the following points, showing application:
 - a. Timber production.
 - b. Watershed protection.
 - c. Soil conservation.
 - d. Experimentation.
 - e. Demonstration.
 - f. Public relations.

- g. Recreation.
 - h. Wildlife management.
 - i. Range management.
 - j. Other.
6. Protective measures necessary.
- a. Fire.
 - b. Insects.
 - c. Diseases.
 - d. Animals.
 - (1) Domestic stock - amount and cost of fencing.
 - (2) Deer, rabbits, porcupines, etc.
 - e. Erosion control.
 - (1) Amount and type of work needed. Cost per unit or acre.
 - (2) Species of trees or plants to be used.
7. Date plan will be subject to revision.

The Plan

1. Priority list of projects.

Project Name	Acres Planted to Date	Plantable Area in Acres		Probable Ad- ditions or New Projects Through Acquisition
		Covered by Intensive Survey	Covered Only: by Extensive Survey	
TOTALS				

Discuss reasons for priority arrangement.

2. The planting job.
 - a. Organizations.
 - b. Methods of planting.
 - c. Species and age classes of stock.
 - d. Spacing and mixtures.
 - e. Planting season (earliest starting date and latest closing date for successful work).
3. Five-year program.

Calendar Year	Project	Acres to be Planted	M Stock Needed	Principal Species	Allotment Required
:	:	:	:	:	:
:	:	:	:	:	:
:	:	:	:	:	:
:	:	:	:	:	:

4. The need for planting experiments, and a list of tests to be established.

Appendix

1. Standards.
 - a. Number of trees per acre required for a satisfactory stand (ten years after planting).
 - b. Correlation of costs and results.
 - (1) Maximum justifiable planting cost per M (based on survival at end of ten years).
 - c. Period over which planting effort on the Forest should be spread.
2. Average planting costs for the preceding five-year period.

Period 19__ to 19__ inclusive. Based on _____ acres.

		Planting Job						
		Ground	Plant-	Trans-	Other	Total	Grand	
		Trees	Prep.	ing	portation	Other	Total	Total
Per A	:	:	:	:	:	:	:	:
Per M	:	:	:	:	:	:	:	:

3. Discussion of results to date, including costs, survival and growth.
4. Discussion of results of nearby State or private planting.
5. Five-year intensive planting survey program.

Calendar	:	:	:	Cost	:	Allotment
Year	:	Project	:	Acres	:	Per Acre
	:		:		:	Needed
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:

6. List of areas by legal subdivisions or tracts to be planted in order of priority.

Project Plans

Prior to the initiation of planting jobs and by October 1, plans and allotment estimates will be prepared and submitted to the Regional Forester for review. Where several small projects are to be conducted simultaneously on a Forest, the plans may be submitted in one report and summarized in tabular form. Instructions in this handbook and in the National Forest Manual should not be repeated in the plan, but deviations from the standards given must be covered in detail.

The following outline contains all of the points to be covered in project plans. Inapplicable subheads will be omitted.

Project Plan Outline and Allotment Estimate

1. Number of acres and location of areas to be planted. Project map.
2. Stock required for each plantation to be established, based on allotment of stock from the nursery.

Project Name:									
Plantation	:	:	:	Seed	:	:	:	:	:
to be Estab-	:	:	:	Lot	:	:	M Trees	:	:
lished by	:	:	:	Number	:	:	Needed	:	Corner
Plantation	:	:	:	&	Age	Nur-	by	Stakes	Posts
Number	:	Area	Species	Source	Class	sery	Species	Needed	Needed
P-10	:	:	:	:	:	:	:	:	:
P-11	:	:	:	:	:	:	:	:	:
P-12	:	:	:	:	:	:	:	:	:
Total	:	:	:	:	:	:	:	:	:

3. Methods of planting, mixtures, and spacing.

- a. Tools and methods.
- b. Mixtures to be employed.
- c. Spacing correlated with species and sites.

4. Training plans.

- a. Dates of and places for training courses.
- b. Designate men or overhead positions requiring special training.
- c. Follow-up training on the job. Methods and responsibilities.
- d. Training plan outline.
 - (1) Subjects to be covered.
 - (2) Method and procedure to be followed in training men for the various jobs.
 - (3) Personnel designated as instructors.

5. Personnel and labor requirements.

Project Name: _____

Job*	No. Men	Rate	Period	No. Work Days**	Man-Days***	Cost
Planting Boss	:	:	:	:	:	:
Stockman-Timekeeper	:	:	:	:	:	:
Foremen	:	:	:	:	:	:
Packers	:	:	:	:	:	:
Truck Drivers	:	:	:	:	:	:
Cooks	:	:	:	:	:	:
Flunkies	:	:	:	:	:	:
Planters	:	:	:	:	:	:
Total	:	:	:	:	:	:

* Revise list as needed for the job to show overhead, supply men, insect and rodent control work, and other special jobs.

** Estimated number of days needed.

***Includes number of days chargeable to planting. Charges to fire and other work are not to be included.

6. Organization and functional duties.

a. Organization.

Number of crews required _____
 Number of crew-days needed _____
 Number of men per crew - Planters, overhead, and tree packers _____
 Number of trees to be planted per day (planters only) _____
 Number of trees to be planted _____

b. Short statement of duties and responsibilities of personnel in supervisory and supply positions. This will include duties and responsibilities of such men as planting boss, timekeeper, foremen, packers, truck drivers, etc.

c. Diagrammatic organization. Show line of authority and responsibility for all jobs given in Caption 5, in addition to Rangers and Supervisor's staff personnel.

7. Equipment needed.

Item or Class	Number	On Hand	: Avail- : able For: : Transfer:	: No. to : be Pur- : chased :	Cost	
					Each	Total
Trucks	:	:	:	:	:	:
Tents - Flies	:	:	:	:	:	:
(itemize by sizes	:	:	:	:	:	:
Tent Floors	:	:	:	:	:	:
Stoves	:	:	:	:	:	:
Lanterns	:	:	:	:	:	:
Cots	:	:	:	:	:	:
Blankets	:	:	:	:	:	:
Ticks or Mattresses:	:	:	:	:	:	:
Trays	:	:	:	:	:	:
Mattocks and Plant-	:	:	:	:	:	:
ing Bars	:	:	:	:	:	:
Telephone	:	:	:	:	:	:
Mess Equipment (not:	:	:	:	:	:	:
necessary to item-	:	:	:	:	:	:
ize that on hand) :	:	:	:	:	:	:
Miscellaneous Tools:	:	:	:	:	:	:
Blacksmith Outfit	:	:	:	:	:	:
Office Supplies	:	:	:	:	:	:
					Total :	:

8. Supplies needed.

Food - need not itemize - refer to previous lists.
Horse feed.
Straw for ticks.
Fuel - wood or coal.

9. Camp details.

Location of camp site.
Telephone communication.
Sanitary arrangements.
Fire tool cache.
Place of planting crew in fire organization.
Location and preparation of heel-in beds.

10. Transportation.

Horses available,
Trucks available.
Tractors available.
Plans for transporting to camp -
Equipment
Supplies
Stock

Costs (exclusive of wages) -

- Hire of horses or other transportation
- Gasoline
- Oil
- Repairs

11. Allotment estimate.

Item	:	Cost
Stock (if purchased)	:	
Transportation (exclusive of wages)	:	
Planting: Labor	:	
: Horse feed, straw	:	
Supervision (include total time for all overhead except cooks and contributed time)	:	
Mess _____ meals @ \$ _____ per meal	:	
: Stakes	:	
Equip-: Corner posts	:	
ment : Paint	:	
: New purchases-See item 8 for detail:	:	
: Maintenance	:	
Other : Laundering blankets	:	
<u>Total Allotment Requested</u>	<u>:</u>	

*Exclude contributed time.

12. Average estimated cost per acre.

Chargeable to allotment estimate in 11 _____

Contributed from other funds _____

Estimated nursery cost of stock _____
(use previous year's cost)

Total Estimated Cost per Acre

Total Estimated Cost per M

13. Calendar of events.

Operation	:	Probable Date
Stock is desired (from F. S. nursery*)	:	
Order stock (if purchased)	:	
Order supplies	:	
Hire planters	:	
Start pitching camp	:	
Heel-in stock	:	
Training school	:	
Planters report to camp	:	
Start planting	:	
Complete planting	:	
Strike camp	:	
Prepare maps and reports	:	

*State point to which shipment should be made. Larger orders are best handled in lots sufficient for a week or ten days' planting.

PLANTING JOB

Training

The job of planting is one in which thorough training produces results. It consists of a series of simple but important operations which integrate to make a complex job. If any one of these operations is poorly done, increased seedling mortality results. All personnel, including supervisory, must be given training for their part in the planting program. The Supervisor is responsible for seeing that every man is equipped with the essential knowledge of his job and is properly instructed in the handling, care, and planting of nursery stock, and the maintenance of required records. Obviously, with the size of the job at hand, it is not possible for a few specialists to train all individual planters. It is, therefore, necessary to train foremen and others who, in turn, can instruct crew members. It is most important that supervising personnel be competent, possess essential information, and be trained to teach others.

It shall be standard practice to hold at least a two-day training session in advance of every planting program. Where the majority of the personnel to attend have not had previous planting experience, a three-day training period will be considered minimum. All crew foremen, timekeepers, and camp and project foremen will attend this meeting. Where the number of men to be trained at a given point exceeds twenty-five, the group will be organized into two divisions.

The aim of every training group will be to see that every man who is responsible for training others is qualified by possession of material facts, understanding of accepted planting technique, and knowledge of how best to pass this information on to others. The last point should be stressed, regardless of the years of experience a man has had in planting work. If a foreman knows how to do his job, but lacks the technique of teaching others, it is vitally important that he become qualified as an instructor. Every training session will be organized to give the men the information needed in handling their particular jobs. Training of foremen will include planting technique, care of stock, crew organization, and records. It is not necessary, however, for a crew foreman to have specific training applicable to a stockman-timekeeper's job; therefore, any group subdivision should take this factor into consideration. There is plenty to be taught the foremen in a limited time, and all non-essentials should be eliminated. Crew organization should be covered in detail to reduce lost motion and time while planting. Likewise, training in the proper planting technique, with emphasis on elimination of false motions, will accomplish increased and acceptable performance.

Teaching by concrete example is superior to abstract dissertation in conference. The same procedure can be followed in training foremen to keep the necessary forms. Examples of problems which they will meet should be developed in advance, and, by actual completion of a sample record, the men can get the feel of the job better than can be obtained in conference. Training men for planting operations and other manual jobs and in the technique of handling nursery stock in the field and in heel-in beds, will be accomplished by the four-step procedure. Forest Officers conducting training sessions will familiarize themselves with this method as a means of securing better work.

Size and Organization of the Crew

Crews will vary in size from 12 to 15 planters working as separate planting units in the crew. The number of men which one foreman can handle efficiently will depend on the individual foreman and on such factors as type of ground cover encountered, topography, and size and shape of the area to be planted. Heavy brush and scrub oak thickets make it difficult to supervise the larger crews. Likewise, on small areas where frequent turning is necessary, a smaller crew will be used. Inexperienced foremen should be limited to smaller crews until they have acquired a thorough understanding of the work and have demonstrated their ability to supervise larger crews. Each crew will have a tree packer whose duty will be to keep the crew supplied with stock and water when and where needed. The tree packer job may be combined with that of the truck driver under certain conditions, thus reducing the overhead by one man.

Crew identity must be maintained so far as practicable. It is good organization to designate one crew for training purposes throughout the season, and as changes are made in crew personnel, the best planters from this group should be selected as replacements. The fastest and best planter will be used as the lead man, the second best man should work next to the lead, and so on down to the end man. One row of flags will be used to guide the flagman and must be moved over as the crew passes. Crews will work in a "stair-step" formation, with the lead man adjacent to the planted area. The second man is one space behind him, the third is one space behind, and so on. This alignment should be maintained, because when one crew member gets ahead of his guide, small patches are overlooked or overplanted and spacing becomes irregular.

Stock Deliveries and Care

Stock will be secured from the nursery currently as needed. This calls for a high degree of correlation between field organization and nursery. It is obvious that sufficient time must be given the nursery in which to fill orders. Ordinarily, the nursery should have at least two days' prior notice in order to schedule the work

in an orderly manner. Order for the first shipment of stock should be at the nursery at least one week in advance of the date desired. Burlap, slats, moss or other packing materials will be returned to the nursery currently. When received, the stock will be checked by the stockman-timekeeper as to condition and quantity, and discrepancies noted on the clearance slip. The slip will then be receipted and one copy returned to the nursery. Notations will be made as to condition of the stock, i. e., dry, heating, bales broken, top damaged, etc. In all cases of serious damage, the nurseryman and planting boss will investigate to determine the cause and will take appropriate steps to prevent such damage in future shipments.

Men in charge of field planting will maintain a small balance of stock (not to exceed two days' supply) in order to absorb any delay in deliveries. This reserve must be kept fresh at all times, the oldest stock to be planted first, without exception. It is good practice to note the date of receipt on the bale slat as it is received from the nursery. Such factors as adverse weather, ground conditions, fire calls, and other emergencies which disrupt planting crews, tend to build up large surpluses unless a close check is maintained and current adjustments made.

Planting stock should be handled as little as possible. Heeling-in stock in a temporary bed in the field is considered unnecessary in most instances; therefore, the majority of it will be handled directly from the nurseries to the field without intermediate heeling-in. The use of beds other than at established camps should be limited to exceptional cases. Under ordinary circumstances, men leaving camp in the morning can take stock with them and return any excess in the evening. When weather conditions are such that spoilage is liable to occur in the bale or container, the stock will be removed and heeled-in under shade. Shipments to be held five or six days before planting will be heeled-in immediately after receipt. Stock must be kept moist at all times, wherever it is, and no temporary beds will be constructed where sufficient water is not readily available. Likewise, stock remaining in the bale or container will be kept moist in transit and at camp. It is the responsibility of the planting boss to keep stock in the best possible condition at all times.

No planting will be done in soils not containing sufficient moisture to keep the roots alive. A prolonged fall dry spell often precedes the beginning of the planting season. Planting done on the assumption that rains will commence any day is too much of a gamble. A prerequisite of planting is soil moisture in sufficient quantity for tree growth.

Stock will not be handled in freezing temperatures. Sometimes moisture will freeze in the tray when the ground is entirely free from frost, and it is best to suspend planting until the temperature rises sufficiently to prevent this.

A careful watch of the condition of stock in planting trays will be maintained at all times. Water should be added as necessary, and planters should be instructed to call for water as needed. Stock should be discarded if it has become dry and has turned a grayish color. Do not assume that stock will revive when water is added, since it may be seriously damaged, and the loss of stock before planting is preferred to wasting additional time and money in planting trees in poor condition.

Counting and grading are done at the nurseries; therefore, field repetition is unnecessary. It may be found desirable to maintain a field check by having one or two in each crew carry tally registers and record the actual number of trees planted, from which the crew output may be computed. Field culling by planters is prohibited except in cases of mechanical injury. Small trees not considered plantable will be put back in the tray for the crew foreman's current inspection. He will make the decision as to plantability.

Methods of Planting

The one-man unit will be followed on all nursery seedling planting, whether with mattock or planting bar. The following cardinal points will be observed:

1. Location of the spot where the tree is to be planted. Other conditions being equal, an even spacing and uniform interval will be observed. Variation from this will be made when natural reproduction, heavy brush, old stumps or rocks are present or under the shade of an established tree. Where a natural seedling of desirable species is found within half of the interval distance of the spot to be planted, the planter will step forward before planting a tree. This will give the natural reproduction its proper weight in relation to planted stock. Heavy brush or trees which interfere with correct planting or will overtop planted trees should be avoided in spot location.

2. The size and depth of holes will be of sufficient dimension to accommodate the root system without crowding the laterals or bending the tap root. It is necessary to scrape away trash and grass which might otherwise drop into the hole. It will be made deep enough to permit all species except longleaf to be planted not to exceed one half inch below the root collar. Longleaf pine will be planted with the bud slightly above the firm ground line. If planted too deeply, it is liable to cause serious silting damage. On the other hand, it has been proved that trees planted too shallow do not survive as well as those planted with the root collar at the ground line or slightly below.

3. The planting bar and Erhart tray will be considered standard for seedling stock on areas relatively free of rock. Transplants or wildings with heavy root systems, or planting on extremely rocky ground, dictates the use of mattocks and the slit method.

Mattock Slit Method

1. Hold the tray in the left hand and the mattock in the right. (Reverse for left-handed planters.) Step forward the required distance and select the spot where the tree is to be planted.
2. Place the tray to the left and slightly ahead of the spot, within easy reach.
3. Clean all grass and trash from a spot sufficiently large to permit the tree to be planted without interference. A quick swipe with the mattock or foot will do the job.
4. In the center of the cleared spot, sink the blade of the hoe the full depth of the blade as nearly perpendicular to the surface of the ground as possible.
5. Pull back on the handle, raising it not more than three inches, opening the slit.
6. Drop to the right knee and, with right hand, grasp the handle near the blade. With the left hand, extract a tree from the tray.
7. Grasp the tree at the root collar with the thumb and forefinger of the left hand. Insert the roots in the slit, pushing well down below the ground level to insure getting the tip of the roots at the bottom of the slit. Raise the tree so that the root collar is coincident with the firm ground level. Shake the tree slightly to free the lateral roots from the side of the slit.
8. Remove the mattock with the right hand and lay it beside the hole. Partially close the hole with the fist. Retain hold of the tree, rise from the kneeling position, and complete closing of the slit with a vigorous thrust of the heel applied in a downward and forward direction about three inches from the tree.
9. Test the tree for firmness, pick up the mattock and tray, and step forward to the next place.

Bar Slit, One-Man Method

1. Hold the tray in the left hand and the bar in the right. (Reverse for left-handed planters.) Step forward the required distance and select the spot where the tree is to be planted.
2. Place the tray to the left and slightly ahead of the spot, within easy reach.

3. Clean all grass and trash from a spot sufficiently large to permit the tree to be planted without interference. A quick swipe with the bar or foot will do the job.

4. Thrust the bar perpendicularly into the ground the full length of the blade, in about the center of the cleared spot. Pull back slightly to open the bottom of the hole. Remove the bar and rest the point about two inches to the rear of the hole.

5. Stoop over and with the left hand select one tree from the tray. Hold the tree by the top and place the roots in the hole, two or three inches deeper than the root collar. With a slight shake of the tree, free the roots from the side of the hole and see that they hang in a natural position. Pull the tree up to where the root collar is coincident with the firm ground line. With a downward and forward motion on the bar, close the top of the hole with enough soil to hold the tree in place. Straighten up.

6. Sink the bar at a slight angle (handle toward you) four inches back of the tree. Pull back on the handle to push the soil firmly around the roots of the tree at the bottom of the hole. Push the handle forward to firm the soil around the roots at the top of the hole. Remove the bar.

7. Close the second hole by sinking the blade about half its depth two inches to the rear of the opening. Twist the bar slightly to loosen the soil. Close the hole with a thrust of the heel to firm the soil near the bottom. Pick up the tray in the left hand.

Note: In planting longleaf, the root collar will be slightly above the firm ground line, not to exceed one half inch.

Supervision and Inspection

The District Ranger will be responsible for all phases of the planting work on his district. He will assist those assigned to particular phases in getting the work under way. Unless specifically relieved by the Forest Supervisor, he will organize and take charge of training camp at the beginning of the job and will make such current inspections as necessary to determine the quality of the work being done.

Inspection of crews will be made by the planting boss and by the project superintendent at least every other day throughout the job. Fire and other work of an emergency character will be the only exception to meeting inspection standards. At least one hour will be spent with the crew at each inspection. Crews not functioning as they should will receive additional attention.

A planting foreman in charge of three or more crews will spend his entire time in supervising the work of the crews. Crew leaders have the responsibility of directing the work of the men. Current inspection will be made by crew leaders and planting foreman. The planting foreman will also make area allocations and determine such planting boundaries as are needed to secure the highest efficiency of his crews. He will be responsible for anticipating the crew needs and for taking the necessary steps to meet them without loss of any crew time.

The natural boundaries and conditions of the area must be considered in laying out crew plans for a given unit. Where one or more crews are served hot lunches at a given point, planting out and back in the forenoon and again in the afternoon will reduce deadhead travel to a minimum. An "L" shaped line of travel is best in some instances. A hollow square in which the center is not planted might be used where it is necessary to omit unplantable land. Men engaged in laying out crew areas must keep in mind that time is lost when a crew ceases planting to change direction or walk through unplantable areas. It may be but a few minutes in each instance, but the aggregate in a day's work can be enough to merit serious consideration. Crew foremen will be taken over their areas and made thoroughly familiar with the plan of action as applied to the job. Foremen should know at all times what is ahead of their crews. Field planting maps should be employed in planning the work.

A crew foreman will supervise the work of the crew and see that each planter understands and uses the best technique. He will see that trees, water, etc., are available when and where needed. He will devote all of his time to planting. Some foremen have a tendency to run errands for stock, water, and other things, leaving their crew for periods of ten to thirty minutes. This should be confined to those infrequent cases where the tree packer has failed to fulfill his responsibility. Inspection and other forms will be kept by the foreman and turned in at the end of each day's work.

Inspection Records

In using Sheet P-1, Daily Inspection Report (see Appendix), the names of the crew will be placed in the left column, and a random sample of five to ten trees dug up and inspected behind each man each day. Each tree will be recorded, using the classification on the sheet. At night, daily scores will be entered, scoring one point for each tree correctly planted. The sheets may be posted on the camp bulletin board or otherwise used to inspire the planters to better work. The use of this sheet also gives the foreman and the planting boss an excellent insight into each planter's work, making it possible to correct mistakes and, where necessary, weed out poor workmen. If inspection sheets show a high percentage of good planting after a crew has been planting at least a week, the

planting boss may reduce the number of trees to be dug and inspected to not less than five per day for each man. District Rangers, project superintendents, and others inspecting the work of the crew will make independent checks for the purpose of comparing results with the crew foremen. Material differences in the score of the inspector and foremen will be closely scrutinized, with a view to securing more uniform results.

Camera Points

Camera points will be established before the end of the first growing season as an aid in maintaining a record of the growth and conditions on typical plantations. The interval should not exceed five years for the faster growing species such as slash pine, loblolly pine, longleaf pine and black locust. The choice of camera points should include some conspicuous object such as a permanent sign, corner post, or distinctive tree. Established points will be noted on plantation maps and cross-referenced to a tabulation giving specific information for positive identification of the point in the field. The tabulation will include a list of the Service numbers of the pictures taken at each point.

Identification Posts

Upon completion of a plantation, one or more durable posts will be erected for the purpose of identifying the plantation on the ground. The location of each post will be noted on the plantation map. Where the boundaries are irregular and not otherwise defined, a sufficient number of posts will be erected to permit easy location. Non-contiguous areas grouped in one plantation will be identified by at least one post on each area.

Each post will be scribed showing plantation number and month and year of establishment. Where they serve the dual purpose of plantation identification and sample strip terminus, the strip number should appear below the identification number. Thus, plantation number 34, planted in February 1949 and examination strip No. 1 would be F-34 2/49, Strip #1 (See page 12 for plantation examination).

Cost Records - Form 134

Cost records will be grouped into four classes:

1. Trees or seed
 2. Ground preparation
 3. Planting
 4. Other
1. Cost of trees or seed obtained from federal nurseries will be secured from the supervisor operating the nursery. actual cost of seed or trees will be used where forests secure them from other sources.

2. Ground preparation will include prescribed burning, disking, and other similar measures. The cost of check dams, soil trenches and brush mulch, frequently employed on severely eroding areas, along with all fence construction or maintenance charges, will be excluded on Form 134 but will be reported by plantations in the narrative section of the annual report.
3. Planting will include direct costs of labor and supervision of sowing or planting; EOR charges for planting machines and tractors and other miscellaneous direct expenses.
4. "Other" will include transportation of trees, tools, equipment, personnel, and other miscellaneous charges not directly chargeable elsewhere. Indirect costs for supervision by the ranger or supervisor will be omitted.

Other Data - Form 134

Forms 134 are the basis for the forest and regional report. They are, likewise, a part of the permanent record of the plantations; consequently, all should be prepared accurately and completely. The following points will be observed in compiling them:

1. The approved project name will be used if one exists; otherwise, the ranger district name should be inserted.
2. Current date will be used in dating the report - not the planting date.
3. Plantation numbers will run consecutively for a project or ranger district. Prefix either the letter "P" or "S" to the area number to designate whether it is planting or direct seeding. Areas replanted will carry the original plantation number and on the same line followed by the letter "R" and the acres replanted.
4. The quantity of stock planted will be given by species, together with the nursery source and lot number. If lot number is not obtainable, the seed source to the nearest county or groups of counties and state should be noted in the Lot No. column.
5. Quality of planting, quality of stock, method of planting, method of mixing species and method of planting will be described to give a concise picture of all phases. If machine-planted, give type of planter used.
6. All planting done with K-V funds will be so noted under "Remarks" by giving the K-V account number. Where K-V and other funds are used on the same plantation, show for each fund the amount of each, including the cost of stock.

7. Under "Remarks" give other pertinent data which will assist in locating the planted area in the future; ground conditions, weather conditions, and similar information.
8. All acreage will be reported to the nearest whole number.

Survival data will be reported by plantation in accordance with outline under "Record of Examination" on the reverse side of Form 134. These data will be included in forest planting reports, and entered on the regional office copies of Form 134. Examinations will be made in accordance with the instructions on pages 12-14.

Outline of Supervisors' Annual Planting and Stand Improvement Report:

An annual report for each National Forest is due on or before July 1. The information requested is limited to that which cannot be secured from Form 134. Particular attention should be given to the tables dealing with artificial measures to obtain natural regeneration. Forest reports will include the following sections:

1. Forms 134 with maps for all plantations established since last report, including plantation examinations reports prepared during the year.

Basic data for each forest are compiled in the Regional Office from Form 134; consequently, the information on these must be complete and accurate.

Forest base maps may be used to outline the area planted, or special maps may be prepared if desired by the supervisor. All maps should be of a permanent nature. Ditto maps may be used if the essential information is outlined in ink. It is unnecessary to require high quality drafting work - clear legible maps will suffice.

2. Narrative Section

The narrative section will discuss briefly all of the salient features of the regeneration program including planting, prescribed burning for that purpose, stand improvement, fencing, stock elimination, survival and other pertinent points. Crew organization and other techniques will be included along with any new practices. Since the report now includes all phases of regeneration, including stand improvement, each type of work should be described briefly. Prescribed burning for seedbed preparation or control of undesirable hardwoods will include techniques used and their costs. Stand improvement will be covered briefly describing organization, techniques employed and approximate costs for various types of work.

It is important that Table 3, Artificial Measures to Obtain Natural Regeneration, be reviewed currently in order that the net total acreage of established reproduction reflect actual conditions on the ground. It is not expected that all prescribed burning for seedbed preparation will result in established stands; consequently, the lost acreage will be very high. The narrative section should cover the salient features of the figures as given, particularly those lost and net total acres to date.

Planting or seeding will be discussed briefly, including labor difficulties, if any, planting machines, or other special equipment used. Particular attention should be given to special problems which affect costs materially and severe losses in plantation survival.

3. Tabular Data

Forms 134, and other tables in the supervisors' reports, will be used as the basis for obtaining data on planting and seeding in Tables 3, 4 and 5 in the regional report. That needed for the block designated "Artificial Measures to Obtain Natural Regeneration" and other data as outlined below must be supplied by the forests:

1. Plantation Examination (all planted and seeded areas)

Plantation: No.	Species	Percent stocked			Remarks (Date examined, cause of losses, number of trees per acre, etc.)
		Thrifty	Unthrifty	Total	
:	:	:	:	:	(Acreage to be dropped as failure identi- fied by number and project)
:	:	:	:	:	
:	:	:	:	:	
:	:	:	:	:	
:	:	:	:	:	
:	:	:	:	:	

2. Knutson-Vandenberg Artificial Regeneration Measures to Obtain Natural Regeneration

State and Forest	Current Years Acres	M Stock or Pounds Seed Used	Total to Date Acres
(1)	(2)	(3)	(4)
:	:	XXXXXXXXXX	:
Total Other Regeneration	:	XXXXXXXXXX	:
Total-Planted, Seeded and Other Regeneration	:	XXXXXXXXXX	:

The preceding tabulation is designed to show only the acreage financed from K-V funds. Where one or more funds are used to supplement K-V allotments, acreage reported above will be determined on the proportion of K-V to other funds.

3. Artificial Regeneration Measures to Obtain Natural Regeneration

State	Class	Year	Years	Date	Acres	Net
and	Forest	Year	Years	Date	lost	Total
	Class	Year	Years	Date	from all	Acres
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	:Original	:	:	:	: XXXXXX	: XXXXXX
	:Repeat	:	:	:	: XXXXXX	: XXXXXX
	:Total	:	:	:	:	: XXXXXX
	:Original	:	:	:	: XXXXXX	: XXXXXX
Total	:Repeat	:	:	:	: XXXXXX	: XXXXXX
	:Total	:	:	:	:	:

Includes all acreage treated for natural seeding such as disking, scari-fying, rodent control, ant control, and prescribed burning. Report net acreage treated for regeneration where the same treatment is given intermingled satisfactorily stocked areas. Acres lost and net total acres to date should be kept current. Acreage reported as "Repeat" (Col. 5) must not exceed that given as "Lost from All Causes" (Col. 6).

4. Current and Average Costs for Artificial Measures to Obtain Natural Regeneration

State	Elements	Weighted Average Costs			
		Current Year	3-year Average		
and	of	Per M	or	Per M	or
Forest	Cost	Per Acre	per lb.	Per Acre	per lb.
(1)	(2)	(3)	(4)	(5)	(6)
	: Artificial Measures to Obtain Natural Regeneration				
	: All Costs	:	: XXXX	:	: XXXX
	: Total	:	: XXXX	:	: XXXX
Forest	: All Costs	:	: XXXX	:	: XXXX
Average	: Total	:	: XXXX	:	: XXXX

Show current and 3-year average costs on a per acre basis. Average prescribed burning costs for all causes may be used where more accurate information is lacking. Three-year average costs will be based on the latest three years' costs of record for the forest, exclusive of the current year figures.

Forest procuring seed either for nursery sowing or direct seeding will report the quantity of cones or seed collected by species and cost including transportation to the designated extractory if paid by the forest. Where seed is extracted other than at designated extractories, cost of seed per pound and quantity obtained will be given.

NURSERIES

Each nursery is an individual project and, as such, distinct techniques must be worked out to produce the best results for the conditions at the particular nursery. Improved methods at other nurseries - Forest Service, State, and private - should be carefully considered at all times with a view to adopting new methods. It is the Supervisor's responsibility to secure the maximum results for the funds expended. The Division of Timber Management will keep the field advised of developments elsewhere.

A plan of work and job foundation will be developed for each nursery. This will include a complete schedule of the jobs to be done in each project and written standards applicable to the particular nursery. These will be maintained currently, and as nursery technique is improved, written standards will be revised accordingly. No attempt is made in this handbook to cover all conditions and situations; only the more general principles and specific instructions applicable to all nurseries are set forth.

Experiments

Many problems need to be solved, particularly where a new nursery has been established. The nurseryman in charge should be constantly alert to recognize difficulties and to devise ways and means of finding out the facts. Many problems can best be solved by detailed experiments, often continuing for a period of years. The forest experiment stations will assist in this work insofar as permitted by funds and personnel. In addition to their work, administrative studies will be conducted by the nurseryman. One study, or more, will be in progress each year, depending on the amount of time required for observations and compilation of the data. Plans of work for administrative studies will be written in advance of establishment. These will follow the accepted form and will be submitted for review with the annual report.

A soil management plan will be developed for the nursery, based on the best information available. This will include:

1. A physical and chemical analysis of the soil.
2. Depth and time of plowing.
3. Soiling and cover crops to be used.
4. Kind and rate of fertilizers or soil amendments to be used.
5. Winter treatments to be given to prevent soil erosion.
6. Insect or disease treatments which alter the PH.

Every effort will be made to obtain from agricultural colleges and experiment stations technical advice on soil management work. Likewise, the Bureau of Chemistry and Soils and other departmental bureaus will be requested to review the plan.

Graphic and written records of the soil management employed will be maintained at the nursery. A map of each nursery compartment will be prepared annually, showing the following information:

- A. Area in tree production.
 1. Species.
 2. Soil amendments; treatment for diseases and insects.
 3. Density secured.
 4. Amount of stock produced in M trees by species per unit.
- B. Area in soiling crops.
 1. Crop sown, amount per acre, dates.
 2. Amount and kind of fertilizer used per acre and dates applied.
 3. Results secured (approximate tons per acre).
 4. Dates of plowing crops under.
 5. Subsequent treatment (cover crops, terracing, etc.).

Other data may be added as needed to show the essential points in the soil management of the nursery and the results produced. The written record will cover in more detail the data shown on the map, in addition to pertinent information not practical to show in graphic form. Special treatments in plowing, disking, and other work done which has a bearing on soil management, will be included. Torrential rains resulting in severe erosion will be discussed in detail in the write-up and will be noted on the map.

The above record will not displace the seed bed record maintained at the nursery. This will be continued without material change, showing lot numbers of seed, date of sowing, germination percentage, lifting date, and other related information.

All nursery cost record data will be kept in the Supervisor's office. The nurseryman is responsible for keeping the

office informed currently of the expenditures by projects in accordance with the Fiscal Control Manual, Vol. 2. The nursery year will end October 31 of each year in lieu of the calendar year.

Progress Report

Progress reports will be submitted not later than the tenth of each month. These will include brief discussions of accomplishments for the previous month, weather conditions affecting the work, condition of stock, progress of improvement, maintenance or construction projects and plans for the immediate future. After approval by the Supervisor, the report will be sent to the Regional Forester, with a copy to each of the other nurseries.

Production Plans

All production plans will designate the forest or unit to receive the stock to be grown and will specify the seed source of each lot. Stock will not be produced for a forest when seed from an approved source for a particular unit is not available. These plans will be submitted with the annual nursery report for review by the Regional Office and for correlation with current needs of the various forests and the amount of suitable seed available at other extractories. Oversowing to the amount of 10 to 20% is desired as insurance against summer losses which would reduce the output below the desired amount.

The nurseryman will take inventories in July and October for each lot of stock on hand, submitting them to the Regional Forester on Form 132 by July 25 and November 1. In the column "Species", add block and compartment designation; in the source of seed column, add year of collection; in the condition column, add shipping age class. The July inventory will include a percentage estimate of the amount of stock that will develop to a plantable size for fall shipment. Stock in the fall inventory designated for immediate shipment will be reported in M trees, plantable size. Forests concerned will be advised by the Regional Office of the amount of stock available. The July inventory can be used as the basis for tentative planting plans, subject to adjustments based on the October stock inventory. As soon as possible after November 1, final allocations will be made by the Regional Office.

Stock Distribution

Forests to receive planting stock will notify the nursery, through the Forest Supervisor concerned, of the amount by species and the dates the stock is desired. Subsequent shipments will be scheduled at least two days, and longer if possible, in advance of shipment. Rush orders for stock will be kept to a minimum and in case the nursery cannot meet the request, the Forest concerned will be notified accordingly. Transportation ordinarily will be by truck,

and unless specific arrangements are made to the contrary, the Forest receiving stock will be responsible for furnishing suitable equipment for its protection en route. Packing material, burlap or containers will be returned to the nursery currently for further use. Economy in the use of trucks and packing materials must be observed to avoid unnecessary costs. Interstate shipment of stock requires a certificate of inspection to the effect that the stock is free of disease. Forests receiving stock from nurseries outside the State will be responsible for initiating action to comply with the State laws.

Immediately after all shipments have been made to a Forest, the nurseryman will send a copy of Form 150 showing the amount and cost of each lot furnished. When current stock distribution costs are not available, the previous year's figures for this item may be used.

Lifting and packing will be so correlated as to obviate heeling-in stock for extended periods. The objective will be to lift and ship within 24 hours. However, periods of greater length may be necessary due to weather conditions and unforeseen changes in field planting plans, but the amount heeled-in must be held to a minimum. Work will be suspended when temperatures drop below freezing. Unnecessary exposure of stock during lifting will be avoided at all times. No stock will be tied in bundles unless it is needed to facilitate handling in the field. Exceptions will be made for the smaller projects where a majority of the stock is to be kept in field heel-in beds.

All shipments will be accompanied by duplicate clearance slips showing the following for each species: number of bales, number of trees, age class, lot number, and seed source. Each bale in mixed shipments will be identified as to species and lot number for field identification. This may be done by attaching a waterproof tag to each bundle or writing the same information on the bale slats. Care must be taken to blank out previous lot numbers on slats returned to the nursery for re-use. Fast-colored lumber crayons should be used to avoid smearing when in contact with wet burlap or water.

Nursery Technique

Because of wide variation in physical conditions and other factors necessitating slightly different methods to effect desired results, it is not practical to outline in this handbook standard methods for growing nursery stock. It is desired to standardize certain practices throughout the Region, and until modified, the following will be considered standard.

Soil Management

Two successive crops of nursery stock will not be grown on the same seed bed area without an intervening soiling crop or other treatment calculated to maintain soil fertility. This means that not more than half of a seed bed area will be used in one year for the production of seedlings. Exception will be made only for areas devoted to experimental work in soil management. The choice of the green manure crop will be limited to the legumes producing the greatest volume of dry weight material per acre. Velvet beans, cow peas, soybeans and vetch have been used with success. It is desirable to plow them under just short of the mature stage rather than later. This is due to the fact that as maturity approaches, the percentage of carbohydrate substances increases, while that of nitrogen and other mineral constituents decreases.

Inventories

The importance of July and October inventories justifies care in preparing them. Planting plans are based on these figures, manpower is arranged for, project allocations are made, and plantation areas are determined; therefore, it is of great importance that close estimates be made of the amount of stock ready for shipment.

The July inventory will be based on a count of not less than 1/10 of 1% when the density of the beds does not vary more than 25% within a given lot or block. Density variation in excess of this will be sampled up to 1/5 of 1%. This may require densities to be mapped for the purpose of taking the correct number of samples within a given block or lot of stock. A templet 1 x 4 feet will be used in determining the area of the samples. This may be further divided into four quadrats by fine wire. The templet affords a convenient base on which to compute densities.

It has been found that a better sample can be secured on drill-sown beds when the templet is placed at an angle across the bed. Irregularities in density because of the operations of the seeder usually occur at right angles to the bed, and to eliminate this factor the templet will set at an approximate 45° angle across the bed.

The October inventory will be based on not less than 1% count of all stock in the nursery and should be accurate within 2 or 3% of shipping count. The stock will be classified into plantable and cull stock on the basis of top specifications for each. This classification will be checked by digging not less than 1/100 of 1%, inspecting the roots for length and development in relation to the top classification. Where root development is erratic, the percentage of trees dug will be increased to 1/50 of 1%.

The shipping inventory will be made, counting the number of trees in randomized samples of bales or containers. At least 5% of the stock will be counted in this manner, but may be increased if it is found that this standard is not accurate within 1% for the nursery aggregate. The inventory for individual lots may vary from 5 to 10%, depending on the size. Small lots will require a proportionately higher percentage to secure a representative sample.

Specifications for Planting Stock

The following tabulation sets forth two grade standards which will be observed in grading stock for field planting. Ordinarily the two grades will not be separated unless it has been clearly demonstrated that satisfactory survival cannot be obtained by the inclusion of both. As other species or age classes are grown as a part of the regular forest planting, descriptive grade standards will be written and submitted to the Regional Forester for review.

In addition to these standards, seedlings with excessively long, spindly stems which will not support the top in an upright position when removed from the seed bed, will not be considered plantable. As a rule, tall seedlings which approach the above will be graded to a minimum caliper and stem characteristics specified in the grade No. 1 for the species.

SPECIFICATION FOR 1-0 PLANTING STOCK FREE FROM MECHANICAL INJURY

Grade No.	Stem Diameter at Root Collar (inch)	Needles	Winter Buds	Bark
LONGLEAF PINE				
1	Not less than 1 1/2. : secondary needle: length	Abundant. Almost : all in 3's or 2's. : with scales. :	Usually present	
2	Not less than 3/16. : secondary needle: length	Moderately abun- : dant. At least : part in 3's or 2's :	Partially devel-	
SLASH PINE				
1	Not less than 3/16. : Stiff; woody.	Almost entirely in : 3's and 2's. :	Usually present.	Usually on entire stem.
2	Not less than 1/8. : Moderately stout to : stout and woody.	Part, at least, in : 3's and 2's. :	Occasionally present.	Moderately developed.
2-a	Not less than 4. : Same as above.	Same as above.	Well developed.	Same as above.
LOBLOLLY PINE				
1	Not less than 3/16. : Stiff; woody.	Almost entirely : in 3's. :	Usually present.	Usually on entire stem.
2	Not less than 1/3. : Moderately stout : and woody.	Part, at least, in : 3's and 2's. :	Occasionally present.	Moderately developed on lower portion.
2-a	Not less than 4. : Same as above.	Same as above.	Well developed.	Same as above.
SHORTLEAF PINE				
1	Not less than 3/16. : Stiff; woody.	Almost entirely in : 3's and 2's. :	Usually present.	Usually on entire stem.
2	Not less than 1/3. Mod- : erately stout to : stout and woody.	Part, at least, in : 3's and 2's. :	Occasionally present.	
2-a	Not less than 3. : Same as above.	Same as above.	Well developed.	

*Needle length is given for longleaf pine, stem length for other species. All roots should be at least 6 inches in length.

Seed Sources

It should be recognized that acclimated seed is an important feature. Data from current seed source studies indicate that generally the best results are obtained from localized collection. Until more information is at hand on which to establish definite seed zones, it is desired that seed collected within a radius of 50 miles be kept as a separate seed lot. Further segregations will be observed for seed collected from locations with elevation differences of 500 feet. This will necessitate a greater number of seed lots than heretofore, but the importance of the relation between seed sources and planting sites justifies the extra work.

All sowing schedules will designate the project or projects for which the stock is being grown. The limitations applicable to seed lots will be observed in designating the projects on which the stock will be planted.

Diseases and Insects

Any insect or disease infestation will be reported immediately to the Regional Office and forest experiment station.

All tree species susceptible to brown spot will be sprayed with Bordeaux mixture to keep the stock entirely free from infestation. This may require two or more applications during the growing season. Just prior to shipment, slash and longleaf pine will be sprayed in an effort to prevent early infestation when outplanted.

White grubs or May beetle larvae (*Phyllophaga* spp) are sometimes quite prevalent in nursery beds. These may be treated with carbon bisulphide emulsion as the damage is noticed. White grubs work from two to five inches underground, cutting off the seedling roots at that depth. Care must be taken in applying the insecticide to prevent burning of the seedlings. Light traps have been suggested as a means of reducing the beetle population around the beds. These operate to attract the beetles and, in flying against the baffles, they drop into traps of oil or water.

Elimination of all oaks known to be alternate hosts of rust canker diseases, *Cronartium cerebrum*, *C. fusiforme*, and infected pine, will be effected for a distance of one-fourth mile from the seed-bed area in an effort to prevent infection of all nursery stock. Current maintenance of the area is necessary to eliminate all of the sprouts. The extent of the oak-free area may be changed on further investigation, but until more is known of the disease, the above standard will be observed.

Frequent sprayings with Bordeaux mixture during the period of spore dissemination has been suggested as a means of preventing

infections. To be fully effective, spray should be applied as new growth appears or rains wash old applications away. Investigations in progress will yield additional information on this subject.

The common red spider (*Tetranychus telarius* "L"), Leconte's sawfly (*Neodiprion lecontei* "Fitch") and scale insects of the genus *Toumeyella* sometimes injure the seedlings. These may be controlled by the use of Bordeaux mixture, miscible oil, and nicotine-sulphate sprays. The Nantucket tip moth (*Rhyacionia frustrana* "Comst.") sometimes infests nursery seedlings. When relatively few seedlings are affected, hand picking may be the best method of control. Heavily infested tops will be dipped in a solution of white oil and water at the rate of one part oil to 100 parts water. An average of 1,000 seedlings per gallon of solution may be dipped before the mixture needs changing for fresh material. A close watch of the seedbeds will be maintained at all times, and as the damage becomes apparent, adequate control measures will be instituted.

Libraries

Reference books, bulletins, pamphlets and other documents on nursery practice, soil management and related subjects will be purchased and added to the nursery library. As new publications become available which are of value to nurserymen as references, they will be placed in the libraries. Supervisors are responsible for requisitioning new material. Full use will be made of the Regional library in the loan of books and other publications which it is not necessary to keep in the nursery library.

Outline for Annual Nursery Report - Due January 15

Capacity

Explain any acreage changes from previous reports, such as enlargements or abandonment, reduction in seed-bed area because of roads, etc.

Production plans for the next five years will be outlined briefly.

Recommended changes, if any.

Water

Discuss amount of water used in relation to past needs and amount of rainfall during the growing period.

Number of times by species and months; average length of period.

Methods used to determine time and amount of watering.

Soiling Crops, Fertilizers, and Amendments

Area sown to soiling crops (segregate where two different crops are sown), preparation, tools used, kind and amount of seed used, method of sowing, kind and amount of fertilizer used, and time and method of application.

Dates of sowing; results in heights and amount of material grown (tons per acre).

Watering - amount used and dates.

Date crops are turned under, how determined, implements used, etc.

Seedling Culture

Preparation of seed-bed, methods used, order of operations, and implements used.

Pretreatment of seed, stratification, acid, soaking, and other.

Tabulate dates of sowing, amount of seed used, area sown, germination desired and secured at the beginning and end of season by species and seed lots, effect of excess germination on present and future planting plans.

Mulching; minimum, maximum and average length of time beds were covered, by species; material used. Unusual behavior in time or rate of germination should be discussed.

Cultivation and weeding, number of times by months and species, implements used, principal weed species.

Root pruning, thinning, and other special cultural work.

Size and development of seedlings by species and age classes in comparison with previous years' work and with accepted standards.

Diseases, insects and injuries, extent, cause of loss, treatment given, method of application, and results obtained; effect of loss on present and future planting plans. Give dates and amount of spray used for brown spot control or other diseases.

Inventories - when and how taken. Compare data with distribution count for previous year.

Sowing schedule for the coming year by species, amount of seed, number of beds, nursery compartments or blocks to be used.

Recommended changes.

Transplants

Amount by species of transplants grown. Discuss briefly the cultural methods employed as outlined for seedlings.

Stock Distribution

Lifting - date commenced, equipment used, grading, bunching, etc.

Packing - number of trees per bale or container, average weight by species, materials used, measures taken to protect stock.

Shipping - minimum, maximum and average truck loads in M trees by species.

Experiments

Studies completed during the year will be given in detail, with conclusions. Pertinent data previously reported will be repeated in the final summary.

Studies in progress will be covered in sufficient detail to permit the use of the data in the final report.

The plan of work for proposed studies will be reported in accordance with the approved outline for administrative studies.

Weather data for the year, date of last frost in the spring, first in the fall, comments on drouth period, excessive rainfall or other unusual features.

Improvements, Maintenance and Equipment

Improvement work completed during the year or in progress.

Improvements or reconstruction work proposed.

Major maintenance work completed during the year or in progress.

New equipment purchased or constructed; changes made in present equipment.

Proposed purchases of new equipment.

Seed

Seed Inventory After Fall Sowing

	:Lbs. on :		: Lbs. Used :	Lbs. :		
	:Hand Last	Lbs. :		: on	: Normal	
Species :	Year :	Received:	Shipped:	Sown :	Hand :	Use
(1) :	(2) :	(3) :	(4) :	(5) :	(6) :	(7)
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
Total :	:	:	:	:	:	:

Column 1 - List species normally sown, including hardwoods.

Column 2 - Exclude experimental storage seed.

Column 3 - Include estimate of amount in extraction process.

Column 4 - Show amount shipped to other nurseries or agencies.
Itemize in footnote.

Column 5 - Amount sown in the nursery.

Column 6 - Net amount on hand.

Column 7 - Normal use based on sowing schedule.

Cone Collection, Seed Extraction and Purchases - Maximum and minimum kiln temperatures and humidities by species; range of time in kiln to open. Show amount of cones air-dried and seed obtained.

Discuss condition of cones received, variations in yields obtained, length of time in curing sheds. Give moisture content of various lots by species, together with the methods used in re-drying the seed. Final moisture content when ready for storage.

Storage containers, temperatures and other protective measures.

New equipment added or changes made in old.

Comments on new developments.

Recommended changes in operation.

Germination Tests - Number of tests by species and lot numbers, technique of securing samples, media used, temperature and physical conditions, length of test and results.

Labor - Supply, suitability, organization used, extractory work, changes made or recommended in organization.

Costs - Discuss briefly the reason for high or low extraction costs for various seed lots; effect of changes in methods of operating on the costs. (Cost form attached)

Nursery Labor

Supply, suitability, rates of pay, number of men obtained from CCC, ERA, and other.

Nursery Costs

Statement of nursery costs for calendar year. (Cost form attached)

Table showing costs by projects compared with five-year average.

Allotment for current year and estimate for next fiscal year, by projects. Changes recommended.

Tabulation of man-days, total and per unit, used on bed preparation, sowing, mulching, removing mulch, weeding, cultivating, diseases, watering, inventories, stock distribution, soil and plant maintenance.

Pictures

Include any pictures taken during the year which are of value in illustrating new equipment, methods, other conditions or results of experimental work.

CONE COLLECTION AND SEED EXTRACTION COSTS

Lot No. and Source	Extractory Costs					Cone Collec-		Total Costs
	Labor	Operating	Supplies	Main-ten-Depre-	Other	tion or Pur-	chase Costs	
	Bushels	Lbs.	Clean	Super-	and	ance	ation	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
								(10)
								(11)
								(12)
Totals								
and								
Averages								

EXPLANATION:

- (1) Include both coniferous and hardwood species under approved plans. Ornamentals and experimental species omitted. Seed specifically designated for cooperating agencies will be shown separately.
- (2) Hardwood species will be shown in pounds.
- (3) Seed stored with wings attached will be reported on the basis of de-winged ready for sowing.
- (4) Includes all labor and supervision of handling cones or seed after arrival at the extractory or curing sheds.
- (5) Includes furnace fuel, power, and expendable supplies.
- (6) Includes maintenance of plant buildings and equipment.
- (7) Includes annual depreciation on buildings, equipment, etc., used in extraction. Items of cost in Cols. 5, 6, 7 and 8 not chargeable direct to a given seed lot will be prorated on the basis of the number of bushels per lot.
- (8) Total of columns 5, 6, 7 and 8 by seed lots.
- (9) Column 10 divided by pounds of seed in each lot as given in Column 4.
- (10) Total cost of collecting and delivering cones to the Nursery. Secure from Forest records.
- (11) Total collection and extraction costs.
- (12)

Table I - Nursery Area and Production

Seedbeds and Transplants							
Total	Available	Current Year	Crops	Other Land	Present	Approved	Possible
(1)	(2)	(3)	(4)	(5)	(6)	(7)	

Explanation:

Areas will be reported to the nearest acre.

- (1) Available acres are reported as area in use current year, plus area in soiling crops and other fallow land ordinarily used for seedbeds. Include roads and paths in the seedbed area.
- (2) Include acreage in seedbeds, paths and roads.
- (3) Area sown to crops for soil-building purposes.
- (4) Include area around nursery buildings, arboretum and other land considered a part of the nursery.
- (5) Amount of stock produced for field planting the current year. Include stock shipped or to be shipped November to March, inclusive.
- (6) Include total amount of stock to be shipped the following year, as authorized by the Regional Forester.
- (7) Estimates of the amount of stock by species and age classes ordinarily grown at the nursery under the approved rotation and soiling crop plan and without enlargement of the seedbed area.

Stock Shipments and Distribution Plans

TABLE III

Species and Age Class	(1)		(2)	
	Stock Shipped	Stock Ready for Shipment	Unit or Forest	Lot No.
	Unit or Forest	Unit or Forest	Unit or Forest	Unit or Forest
	Totals	Totals	Forest	Forest
TOTAL				

Explanation:

(1) Tabulation of the shipments made to forests.

(2) Tabulation of the distribution plan for the crop on hand.

NOTE: When it is not known where the stock will be planted, the group of forests receiving it may be used, e.g., shipments to Texas, with more than one National Forest, may be designated as "Texas". Stock for cooperating agency will be shown separately in a "Unit or Forest" column.

TABLE IV Sowing Schedule and Distribution Plans for Next Calendar Year

Age Class and Species	Sowing Schedule		Distribution Planned				Total
	Lot No.	Geographic Source	Forest	or	Forest	or	
Year	Beds	Unit	Unit	Unit	Unit	Unit	Unit
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
TOTALS	:	:	:	:	:	:	:

Include under distribution planned all stock to be shipped to the forest, including 2-3, 1-1, etc.

TABLE V - Average Total Cost (Including Stock Distribution) of Stock Grown

Species	Age Class	Cost per M	
		Current Year	5-year Average
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:

Miscellaneous species grown for ornamental planting may be grouped under one heading.

Five-year average, exclusive of current year. Data for less than a five-year average will be given when the species has not been grown for six years or longer. Explain by footnote.

SEED COLLECTION AND EXTRACTION

Collection

Method of Estimating Cone Crop

Cone crop estimates are due from all forests not later than July 31, on Form P-26 R-8. These will show amounts of cones by species which can be collected, and estimated costs of collection. Allocation of quotas for various species, based on inaccurate information, can seriously handicap the planned progress of the planting program where these cannot be met, or an underestimate of quantity and quality available may necessitate the collection of seed elsewhere at higher costs. When seed is needed yearly in the quantities now being sown, seed crop estimates must be made accurately. Estimates will be based on actual cone counts on native trees. The following method is suggested for obtaining data on the current cone crop. Variations from the outlined survey method are expected to meet local conditions.

1. From the timber survey map, outline the location of the timber type which is producing the seed upon which an estimate is desired. Determine the acreage.
2. Secure an actual count on 1/5-acre plots of the number of cones on each tree by species and number of stems. Due allowance must be made for trees bearing less than a collectible amount of cones.
3. Compute the number of bushels by species for the area surveyed.

The survey may be made by spacing plots mechanically along the road and plot lines at right angles to it through areas from which collections are contemplated. Not less than 1/50 of 1% of the area should be covered by an actual count. Fifty thousand acres, for example, would require one plot for each thousand acres, or a total of fifty plots on which to base a cone crop estimate for the area. Frequently, there is an appreciable difference in the price of collecting cones between various stands on the forest, and the estimate should be segregated to show this difference. This will make it possible to select those areas showing a cheaper collection cost when plans for the work are formulated.

Number of Cones per Bushel, by Species

<u>Species</u>	<u>Average Number Cones per Bushel</u>	<u>Average Yield Clean Seed (Pounds per Bushel)</u>
Longleaf pine	100	.9 - 1.50
Slash pine	200	.8 - 1.20
Loblolly pine	500	.9 - 1.30
Shortleaf pine	2,000	.8 - 1.30
White pine (eastern)	-	.7 - 1.04
Yellow poplar	-	10 - 13.60
Spruce (red)	-	.7 - 1.03
Black locust	-	1.00 - 2.00

A sample of the cones should be tested to avoid collecting too early. Past experience indicates that difficulty is encountered in extraction if cones are collected too early. Cones which will float in #20 Gulflube immediately after being picked from the trees, are ready. Testing should be done in the field as the cones are removed from the trees.

The following table gives the approximate dates of maturity and opening of cones or fruits. Variation from these dates because of altitude and seasonal climatic conditions can be expected; therefore, actual dates when seed is ready for collection must be determined by inspection.

<u>Species</u>	<u>Ripening</u>	<u>Collection</u>	<u>Opening on Trees</u>
Longleaf	Sept.15 - Oct. 20	Oct. 1 - Oct. 20	Oct. 20 - Nov. 10
Slash	Aug. 15 - Sept.10	Sept. 1 - Sept.20	Sept.20 - Sept.30
Loblolly	Sept.20 - Oct. 10	Oct. 1 - Oct. 20	Oct. 10 - Oct. 20
Shortleaf	Oct. 1 - Oct. 20	Oct. 11 - Oct. 30	Nov. 1, on
White pine	Aug. 1 - Aug. 30	Sept. 1 - Sept.30	Sept.30, on
Poplar	Sept.15 - Oct. 15	Oct. 15 - Nov. 15	Nov. 15, on
Spruce	Sept.15 - Oct. 1	Oct. 1 - Oct. 31	November on
Black locust	Oct. 1	Oct. 15 - Nov. 15	November on

It is desired that each forest collect the seed necessary for its own reforestation program. Due to the annual variation in cone crops, it will be impossible to meet this objective at all times. For this reason, seed collection quotas will be assigned to each forest by the Regional Office by August 10 of each year.

Cones (or other tree fruits) are most economically gathered on cutting areas either on National Forest sales or private cuttings. Where cutting has been carried on through the summer and early fall, care must be exercised to avoid collecting immature seed from trees

felled prior to the ripening of the cones. It is sometimes possible to arrange with an operator to plan cutting so that a particular body of timber will be cut at the proper time to be available for cone collection. Where cutting areas are not available, it will be necessary to organize crews to collect from standing trees.

Seed collection will be made from thrifty trees of good form growing in optimum conditions in regard to climate and soil. Research in tree genetics indicates that the influence of such factors is transmitted through the seed. Collections should not be made from stands in transition zones or at the limits of a species range. Coastal Plains sand areas supporting a sparse growth of timber of poor form should not be considered as a source of seed unless the seedlings grown will be planted on comparable sites. Areas of National Forest land supporting stands suitable for seed should be located and may be reserved for such purposes. Stands readily adjacent to a labor supply and the extractory might be reserved from cutting until other areas in the same localities become of seed-bearing age.

Organization

Collection crews will be organized to obtain the maximum efficiency and will vary with the type of timber. Ordinarily, a unit will consist of two men climbing the trees and cutting the cones off the limbs, and one ground man picking up and sacking them. It is good practice to alternate with the ground man if all are qualified to climb. Every precaution for the safety of the men should be observed. Such practices as racing up and down the trees, refusing to use safety belts properly, working in reach of falling cones, and other unsafe practices must not be permitted. All equipment such as ladder, belts, cone hook and spurs must be inspected daily. Weak, unsafe equipment will not be used until it is repaired or replaced.

Cone or Seed Procurement

Purchase of cones will be limited to such amounts as cannot be collected economically by our own organization. Due to possibilities of obtaining an inferior grade of cones or seed, specifications will be clear-cut and rigidly enforced in all transactions, whether obtained by bid, open market purchase or other contract procedure. Sufficient field inspection and sampling of the offered cones will be done to assure the fulfillment of contract requirements. The purchase of extracted seed will be limited to exceptional cases and only with prior approval of the Regional Office. Purchases will be contingent upon an acceptable germinative energy as determined by tests and certification as to species and origin.

Cone Procurement Requirements

It is necessary for the Forest Service to procure its needed supply of seed cones at the lowest cost obtainable for an acceptable quality to procure them in accordance with the regulations, and to so handle the job as to eliminate so far as possible profits to middle-men, thus, as a rule, insuring that funds are disbursed to the individuals who do the collection work. The following plan is designed to accomplish these objectives so far as practicable. The procurement methods are stated in the order of preference under normal conditions.

1. The direct collection by Government employees already in the Service (such as CCC enrollees) on either National Forest land or private land for which collection leases have been secured as prescribed under A.

2. The employment of extra common labor at hourly or daily rates to supplement that under No. 1 where desirable to handle by direct collection by Government employees and where reasonable production for the wages paid will be assured. This plan might be desirable on a large tract involving a large quantity of cones where close supervision over collectors is possible and where, otherwise, bids would have to be secured for either outright purchase or contract collection.

3. Where the quantity required at any one time in any one collection area (seed lot) will not exceed the open market limit (\$500 for P & M), cones may be procured by direct purchase from farmers and collectors without the written solicitation of bids. Prices should be verbally solicited from the individuals before issuing orders, but orders should not be placed for purchase at prices in excess of what it would cost to procure the cones by other means.

4. Where over \$500 worth of cones are desired at one time in a collection area, bids drawn as indicated under C will be issued only to landowners who will probably wish to do their own cone picking and to other individuals who, there is reason to believe, wish to pick cones for sale, and award will be made to the lowest acceptable bidders for the quantities of acceptable cones quoted upon until the total quantity desired is awarded. If the prices are considered unreasonable and in excess of the cost through purchase in the open market or through direct collection, bids should be rejected and procurement otherwise made as most advantageous.

5. The quantity of cones needed over and above those procured under methods 1 to 4 should be procured from National Forest or private lands through collection contracts providing for services of self and equipment in collecting and delivering cones to

a specified point at a specified rate per bushel. See sample below under B. These contracts should be negotiated with the individuals who most logically should do the work provided their prices are the lowest obtainable. Where collection will be on private land, collection leases giving the Forest Service a right to the cones should first be negotiated as outlined under A, and the owner of the land should also be given the collection contract if agreeable to him. Competition will first be obtained if the cost of collection in a locality susceptible of handling as one job will exceed the open market limit (\$50 for P & M and \$300 for CCC). See D for sample bid.

A. Cone Collecting Lease - It is very desirable that written permission for the collection of cones on private land, by force account or by contract, be secured from the owner. This will be accomplished by the execution of a "Cone Collecting Lease", the form for which appears below. It is not necessary that a money consideration be paid for the lease; in fact, where the landowner is to be given the collection contract, under No. 5, ordinarily there should be no charge for the right to take the cones. If other than the owner is to do the collection work, the owner may ask a payment for the right to collect, in which event the lease should be changed as indicated below and a money consideration inserted. Outright purchase of picked cones delivered at a specified point requires no collection lease or collection contract, but purchasing officers should satisfy themselves that the vendor has title to them.

Cone Collecting Lease

United States Department of Agriculture

Agreement between

John Smith, Landowner
and

Forest Service, U. S. Department of Agriculture

1. This agreement made and entered into this _____ day of _____, by and between _____ hereinafter called the party of the first part, and the U. S. Department of Agriculture, Forest Service, hereinafter called the Forest Service:
2. For and in consideration of the benefits accruing to the communities and to forestry practice in general from the reforestation of cut-over lands within the National Forests, the party of the first part agrees

to lease the following described lands to the Forest Service without charge for the purpose of gathering and removing such quantities of pine cones as the Forest Service may desire and for no other purpose, between _____ and _____:

(Description of land)

3. The Forest Service shall have exclusive right to gather cones on the land described herein during the period stated.
4. The Forest Service, its employees and contractors, shall have the right of ingress and egress over any lands of the lessor as necessary for the purpose of removing cones from the above described area.

IN WITNESS WHEREOF the parties have hereunto subscribed their names as of the date first written above.

Witness for the party of the first part _____

(Address)

Witness for the Forest Service _____

(Title)

The agreement will be signed in duplicate, the original to be retained by the Forest Supervisor and the duplicate by the landowner.

If the owner will not grant permission without charge, clause 2 will be changed as follows:

"For and in consideration of the sum of \$ _____ payable within a reasonable time after the close of the period of this lease, the party of the first part agrees to lease the following described lands to the Forest Service for the purpose of gathering and removing such quantities of pine cones as the Forest Service may desire and for no other purpose, between _____ and _____:

(Description of land)

"The Forest Service shall have exclusive right to gather cones on the land described herein during the period stated."

A lump sum figure is preferable to a quantity basis for payment of the collecting lease because of the need in the latter case of maintaining records to substantiate the amount due the owner. Collections from intermingled lands would add to the confusion and chances for error.

Vouchering: Any rental charge will be vouchered in the usual manner about as follows:

Sept. 1 to Nov. 30, 1937	For rental of 360 acres in Secs. 10 & 11 T21 N R15 ECM for cone gathering purposes. For the period \$10.00.
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Note: The period should be the full period of the agreement, not necessarily the shorter period of actual gathering. Gratis permission, of course, will require no voucher.

B. Collection Contract - Where cones on National Forest or private land are to be collected by contract hiring of man and equipment, as outlined under No. 5, the following procedure will govern:

(a) If the cost of collection in a locality susceptible of handling as one job will not exceed the open market limit, the agreement form appearing below (changed as necessary to meet local conditions) should be executed with the person who is to do the collection work.

(b) If the cost as in (a) will exceed the open market limit bids should be solicited. In this case the bid specifications should include the essential points of the agreement form and the separate agreement will be unnecessary. Award should be made in a manner similar to purchase bids; i. e., to the lowest bidder on the quantity he agrees to collect until award of the entire quantity to be collected is made.

(c) If the cost will exceed the open market limit, but the owner of the land from which collection will be made or some other person is the only one within a practicable distance who can perform the collection work within the time available, and bids are not practicable, the agreement form will be executed and supported by exigency statement.

Agreement for Hire of Man and Equipment
For Cone Collecting & Delivery

Date _____

John Doe, contractor, of Brooklyn, Mississippi, hereby agrees to furnish to the Forest Service, U. S. Department of Agriculture, at Brooklyn, Mississippi, the services of himself and the following equipment:

One truck, $1\frac{1}{2}$ -ton Chevrolet, two ladders and four picking sacks, on or before _____, for the purpose of picking cones from trees and hauling to the Ashe Nursery (state location) longleaf and slash pine cones as desired by the Forest Service in an undetermined amount estimated to be 100 bushels of longleaf pine and 50 bushels of slash pine cones from the following described lands: National Forest lands in Sections 10 & 11, lands owned by Richard Roe in Sections 11 & 12 & 21 N R 15 ECM.

The Forest Service will make payment as follows: Longleaf pine cones, \$.30 per bushel; slash pine cones, \$.40 per bushel, delivered at the nursery, payable subsequent to complete delivery of one or both species of cones collected.

The cones accepted at the Ashe Nursery must be in accordance with the attached specifications, which are made a part of this agreement. Cone sacks and shipping tags will be furnished by the Government as necessary for proper identification and handling of the cones upon arrival at the Nursery.

The contractor will assume all risk of loss, damage or destruction of equipment or damage to timber stands and property from which cones are collected; and for personal injury to himself or persons working under his direction.

Collection or delivery will not commence prior to _____, for slash pine cones, and _____, for longleaf pine cones, and will not extend beyond _____ for both species.

Eight-hour Law -- No laborer or mechanic doing any part of the work contemplated by this contract, in the employ of the contractor or any subcontractor contracting for any part of said work contemplated, shall be required or permitted to work more than eight hours in any one calendar day upon such work at the site thereof. For each violation of the requirements of this article a penalty of five dollars shall be imposed upon the contractor for each laborer or mechanic for every calendar day in which such employee is required or permitted to labor more than eight hours upon said work, and all penalties thus imposed shall be withheld for the use and benefit of the Government: Provided, That this stipulation

9. Clear-cut specifications as to the definition of acceptable cones and conditions must be attached to the agreement.

10. The provisions of the eight-hour and prison labor law must be made a part of the contract.

The contract will be signed in duplicate, the original retained by the Forest Supervisor and the duplicate by the contractor.

Vouchering: Payment to collecting contractor will be vouchered on Form 1034 voucher in somewhat the following manner:

1937
10/1 to 10/31 - For services of self and equipment in gathering Government cones from trees in the forest and delivering same to Forest Service Nursery, 100 bushels of longleaf cones at flat rate of 30¢ per bushel for entire service \$30.00.

Under No. 4 on the back of the voucher form, the absence of competition will be explained in the same manner as for any other open market purchase from regular funds. If the estimated amount will exceed the open market limit, collection will be handled by bids or exigency statement and vouchered accordingly. If by bids, the separate agreement is unnecessary, but it is required if by exigency statement.

C. Cone Purchase Bids - There follows a suggested form of bid. The aim is to encourage bidders to quote on whatever quantity they estimate they can furnish and to relieve them of liability up to 50% due to inability to perform because of poor crop conditions. Otherwise, bids will be handled in the usual manner. Any other requirements such as delivery time and point, etc., should be included.

The Forest Service desires to purchase approximately _____ bushels of _____ and _____ bushels of _____ pine cones collected from trees within _____ (description general area)

The cones must be in accordance with the specifications on attached sheet and must be delivered by bidder at _____ for the price quoted.

Bidder will state below the quantity of cones he will agree to furnish and his price per bushel.

I hereby offer to furnish under this bid the following:

_____ bushels of _____ pine cones at _____ ¢ per bushel
 _____ bushels of _____ pine cones at _____ ¢ per bushel

with the understanding that I will be relieved of liability for up to 50% of the above quantities only in the event that I am unable after reasonable effort to collect or otherwise procure them of satisfactory quality due to crop conditions within the area described.

Notice: The Forest Service recognizes the probability that one bidder will be unable to supply the entire quantity of cones desired. For that reason bidders are requested to quote on as many bushels as they estimate they can furnish. Award will be made to the lowest bidder for the quantity he offers, to the next lowest bidder for the quantity offered by him, and so on until the entire quantity desired is awarded. The Forest Service also recognizes the impossibility of estimating crop conditions with sufficient accuracy that bidders may reasonably guarantee quantities and for that reason a bidder may, without liability for non-performance, reduce deliveries below the quantity for which his bid is accepted by the quantity which he is unable to collect or procure because of crop conditions after reasonable effort, not to exceed, however, 50% of the quantity awarded. It is further understood that the Forest Service may order up to 25% more than the quantity awarded at the price quoted if the bidder is able to furnish them.

(Follow with cone specifications and other requirements or refer to attachments containing them.)

D. Bids for Cone Collection:- Below is suggested wording for collection bids. The provisions should be changed as necessary to fit conditions and any needed specifications should be added:

Bids are invited for the collection of pine cones of the species, in the quantities, and on the areas listed below. Bidders will please quote their price per bushel for the complete job of picking from trees, sacking, and delivery at _____. Bidder will furnish all labor and equipment and will assume full responsibility for injury to persons and damage to equipment and other private property.

<u>Item</u>	<u>Cones to be Collected</u>
1	On lands owned by _____ described

as _____

_____ bushels of _____ pine cones at _____ ¢ per bushel

_____ bushels of _____ pine cones at _____ ¢ per bushel

2 On lands owned by _____ described

as _____

etc.

Quantities are estimated only. Successful bidder will be required to collect all cones available and ordered by the Forest Service on the area described. A bid for collection of only a portion of the cones desired on an area will not be considered. Award will be made separately for each area to the bidder offering the lowest price for the area.

- 3 Eight-hour Law -- No laborer or mechanic doing any part of the work contemplated by this contract, in the employ of the contractor or any subcontractor contracting for any part of said work contemplated, shall be required or permitted to work more than eight hours in any one calendar day upon such work at the site thereof. For each violation of the requirements of this article a penalty of five dollars shall be imposed upon the contractor for each laborer or mechanic for every calendar day in which such employee is required or permitted to labor more than eight hours upon said work, and all penalties thus imposed shall be withheld for the use and benefit of the Government: Provided, That this stipulation shall be subject in all respects to the exceptions and provisions of U. S. Code, title 40, sections 321, 324, 325, and 326, relating to hours of labor.

The contractor shall not employ any person undergoing sentence of imprisonment at hard labor.

Cone Specifications

The following provisions are suggested as a basis for the purchase of cones or contract for cone collection. Others may be added as warranted by local conditions.

1. General - All cones must be ripe cones of the current year's crop of the species specified. They must be free from mold,

worms, needles, twigs and trash. The cone scales must not have opened to the extent which would permit the loss of seed.

2. Ripeness - The bid will specify the period in which the cones will be collected. This will not commence prior to the time freshly picked cones float in Gulflube #20 or similar oil. A random sample will be cut longitudinally and the seed examined for defect as deliveries are made.

3. Source - Collections will be made from areas designated and accepted on the ground by a qualified forest officer. Collection from outside the designated area will be the basis for rejecting all cones collected.

4. Packing - Cones will be sacked in one or two bushel burlap sacks. The sacks must be free from holes and their strength not weakened by rot and mildew. The mouth of the filled sack will be closed by sewing or tying with stout twine or cord. Wire will not be acceptable. Each shipment will be identified by a tag showing the collector's name and address, species, and date of collection. Mixed lots will be identified with a tag on each sack.

5. Measurement - The quantity of the cones shall be determined on the basis of a bushel by volume, not weight. All cones purchased or secured by contract will be accurately measured upon receipt at the extractory.

6. Delivery and Temporary Storage - The sacked cones are to be delivered for inspection and acceptance at designated points on specified dates. Temporary storage at this point and any other will be such as to prevent heating and mildew. Cones showing signs of either will be rejected as unsatisfactory.

Costs

Cone collection costs for southern pine seed are quite high because of relatively low seed yields and large sized seed. It is, therefore, necessary that careful attention be given to the organization and execution of all cone collecting activities if high seedling costs are to be avoided in subsequent planting. Collection data will be reported in accordance with the outline in the annual planting report.

Extraction.

The extractory, cone sheds and adjacent grounds will be kept clean and shipshape at all times. Dust and trash will be removed daily. Every precaution will be taken to prevent fire from starting.

Tested extinguishers will be conveniently located throughout the buildings; hydrants and hose will be checked frequently. Smoking in and around the buildings will be prohibited at all times.

Seed Lots

For identification purposes, each cone lot at the extractory will be assigned a number, followed by the year and place of collection. Lot numbers will run consecutively by years for each species. For example, longleaf pine will be numbered: 1 - '37, DeSoto, Leaf River District; 2 - '37, Pike County; 3 - '37, Jasper County, etc. Collections from two adjoining Ranger Districts or counties may be included in the same seed lot.

Cone Curing

Cones will be placed in curing sheds as pre-treatment to extracting the seed. The curing period will depend upon weather conditions, species, and the time the cones were placed in the sheds. This may vary from ten days to two months. Sufficient time should be allowed for the cones to partially open before placing them in the kiln. It is important that ample space be left for cones to expand in the bins; otherwise, air circulation in the curing sheds is greatly retarded, and cones are likely to mold or heat. Cones will not be left in the burlap sacks longer than necessary after arrival at the extractory.

Kiln Operation and Cleaning

Information as to lethal temperatures and humidities is meagre for southern tree seeds, and it is extremely important that complete records be kept on all phases of cone storage and seed extraction in order that specific data be available for correlation with germination tests. Kiln operating temperatures will not exceed 115°F for longleaf and slash pine and 120°F for shortleaf and loblolly pine. A temperature record will be kept of every kiln charge.

Moisture content will be determined for all seed extracted or purchased. Data on hand indicate that this should be about 10% for best results when placed in storage. Samples will be oven dried at 212°F to a constant weight and the loss in weight used as the basis for calculating the weight of a given lot of seed when dried to contain the desired moisture content. Temperature during the drying process must not exceed 100°F.

Seed Storage

Seed will be stored in flat-topped GI cans, or burlap bags until used. Seed not needed for spring sowing will be put in cold storage plants at 32 to 38°F. This applies particularly to longleaf, slash, and loblolly pine seed. Shortleaf pine may be kept three or

more years at room temperatures in airtight containers. There is much to learn relative to the storage of seed and until more reliable information is available, the above practices will be observed. The seed in each container will be identified as to lot number, species, source, percent of moisture, viability and date of last test. Form 342 will be used for this purpose, or if additional data are desired, special forms may be used. Where such are used, the above minimum requirements will be observed. A completed form will be placed inside the container.

Seed Testing

Germination tests will be made for each lot of seed and used as a basis to determine quantities of seed to be sown per unit of area. Due to the probability of deterioration during the storage period, testing will be scheduled on the basis of the amount of seed that can be sown within a given period in which there will be no material deterioration subsequent to testing. Ordinarily, this should not extend beyond a two weeks' period.

Large seed lots will be segregated into sowing lots for the purpose of testing and field sowing. It is extremely important that all seed of a given sowing lot be thoroughly mixed. The size of the sowing lot will be governed by the following:

1. Size of the seed lot.
2. Amount of seed which can be mixed conveniently.
3. Length of time sowing will be in progress.

Every effort must be made to mix thoroughly all seed in a given sowing lot. The variation in germination of seed in separate containers is frequently great enough to result in light and dense stands in the seed bed. Likewise, late sown beds may require more seed than those sown earlier. It is, therefore, necessary to subdivide the larger seed lots at the time seed samples are secured for germination tests.

Schedule of testing should approximate closely the time of actual sowing at the nursery. Tests made immediately following extracting are sometimes considerably higher than those of the same seed sixty or ninety days later. Therefore, all tests to be used in computing quantities of seed to be sown will be made not to exceed forty days prior to the date set for the nursery sowing.

The quantity of seed to be stratified or pre-treated in other ways prior to sowing must be anticipated far enough in advance to permit such treatment prior to testing. Selected samples will be given the same treatment as planned for the sowing lot, in

order that a comparable germination test can be secured. At the present time the Southern Forest Experiment Station is cooperating by making seed tests for all nurseries. This will be continued until such time as the research project now under way is complete. Additional information on this phase of the work will be furnished from time to time as the project progresses and summaries are completed.

Sampling

Samples will be selected from the top, middle and bottom of each container making up the sowing lot. The size of the sowing lot should not be larger than that which cannot be thoroughly mixed prior to sowing. This may require that individual seed lots be divided into two or more sowing lots and tested separately. Samples drawn from the container must contain at least 400 seeds, or approximately 130 seeds from the three relative positions in the container. For any given lot, not less than thirty 130-seed samples will be taken and mixed together, from which a representative germination sample will be taken. Where the containers vary in size or amount of seed that each contains, a proportionately larger sample must be secured from the larger bulk of seed. Not less than four duplicate tests of 250 seeds each will be made for each sowing lot. The average germination obtained for the entire lot will be taken as average of the lot except where it is apparent that exceptionally low results are obtained from one unit not attributable to the quality of the seed tested.

Data on technique of seed testing indicate that many factors heretofore not considered have a material bearing on the results. The presence or absence of light, the testing media, temperature variations, moisture, and depth of sowing are the most important. It is, therefore, important that the proper technique be observed in conducting all tests. Until more specific data are at hand, the following will be observed.

1. Clean, fine, sterile sand is preferable as the germinating media. Peat mats may be used where facilities do not permit the use of sand.

2. Sand flats will be 10-1/2" x 10-1/2" x 3-1/2" inside measurements. At least three inches of sand will be used in each flat.

3. Seed will be covered to a uniform depth of not to exceed 1/8" from the center of the seed.

4. Tests will be conducted at room temperatures, with no attempt to maintain an even temperature except to prevent freezing.

Lower temperatures are expected at night.

5. Direct, uniform sunlight is needed for best results. Burlap covering or stacking of sand flats will be avoided.

6. Excessive moisture inhibits germination. Sand will be kept moist but not saturated.

7. Germinated seed will be removed at stated intervals as the counts are made.

A summary of all germination tests will be maintained which will be correlated with the storage methods used, moisture content of seed and the results obtained for individual lots in the nursery beds. Our fund of knowledge on all phases of seed storage and germination in the sand flats and seed beds is very limited. It is, therefore, necessary that definite effort be made at each nursery to contribute specific information based on conditions at the nursery.

Extraction Records

A systematic method of recording extraction and seed data is necessary to make the information readily available. The quantity of cones handled is large and in the process of removing the seed, the chances of confusion make it practically mandatory to devise a system of records through which seed identity can be maintained. Furthermore, pertinent data on kiln operation are desired for all seed extracted.

The forms in the appendix have been developed for recording the above information and are designed to keep the various lots segregated. The seed storage and disposal record for any given year will remain active as long as seed of that year is on hand.

In addition to the above, cost data on kiln operation are necessary to determine the cost of seed. Maintenance and depreciation costs will be handled in the same way these charges are handled in the nursery cost accounting system. These data will be reported in accordance with the table contained in the outline for the annual nursery report.

1. The purpose of this document is to provide information regarding the activities of the organization and its members.

2. The information contained herein is classified as CONFIDENTIAL - SECURITY INFORMATION.

3. This information is intended for the use of authorized personnel only.

4. The information contained herein is to be controlled and disseminated in accordance with the policies and procedures of the organization.

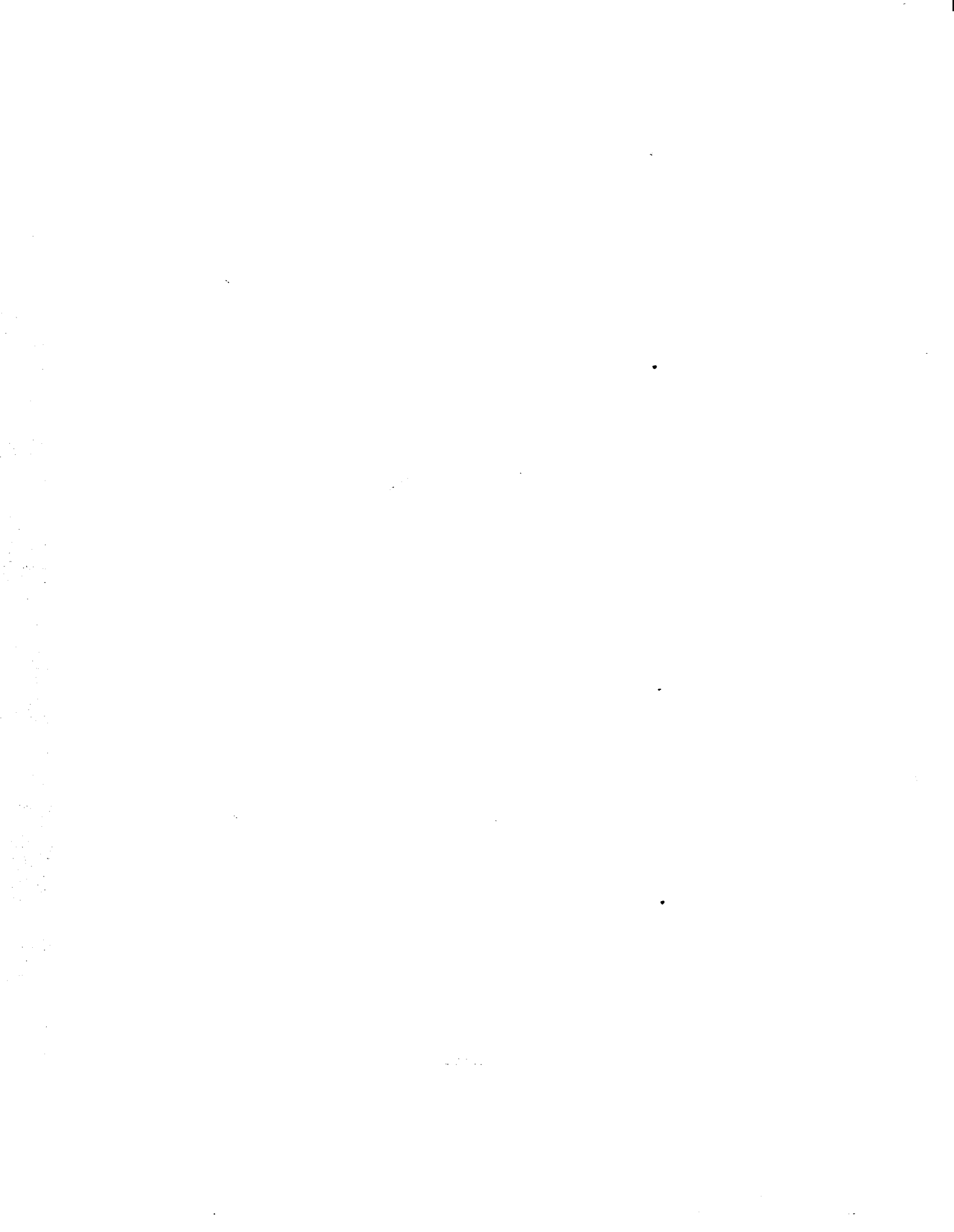
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A P P E N D I X



(Sample)

CONE COLLECTION

Extractory SHEET OF

Assigned Lot No. _____ Curing Shed No. _____

Species

		Collection Data									
Date Rec'd.	Amount in Bushels	Unit	Total	Date	Locality	Elevation	Class	Age	Remarks		
Shipper	3	4	5	6	7	8	9	10			
1											

Total for Sheet
 Brought Forward
 Total to Date

DAILY PRODUCTION SHEET

(To be completed by
crew foreman daily)

Date _____

Foreman _____

Leader (or Assistant Leader) _____

Camp No. _____

Project _____

Plantation No. _____

Species & Lot No. _____

M Trees planted by crew _____

Number of men in crew _____
(Include tree packers)

Number planted per man-day _____ No. Planters _____
(Planters only)

*Number of hours crew is in field _____

Total man-days _____
(Supervision) (Labor)

*Less than eight hours will be explained by footnote as - Rain, Half-Holiday, Completed job, etc.

(To be summarized on Saturday of each week and weekly summary sent to the District Ranger on Form P-3. This form will be kept on file at the camp).

(Sample)
NURSERY STOCK SHIPMENT RECORD

(Three copies: Two with the load, one to be signed and returned to the nursery.)

Shipment No. _____

Truck No. _____

Date _____

Driver _____

_____ Nursery.

Destination _____

Species	Lot No.	No. Bales	No. M Trees
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:

Filled by _____

Checked by _____

Received by _____

ACTIVITY EXPENDITURE RECORD

Project: _____
(Account No. and State)

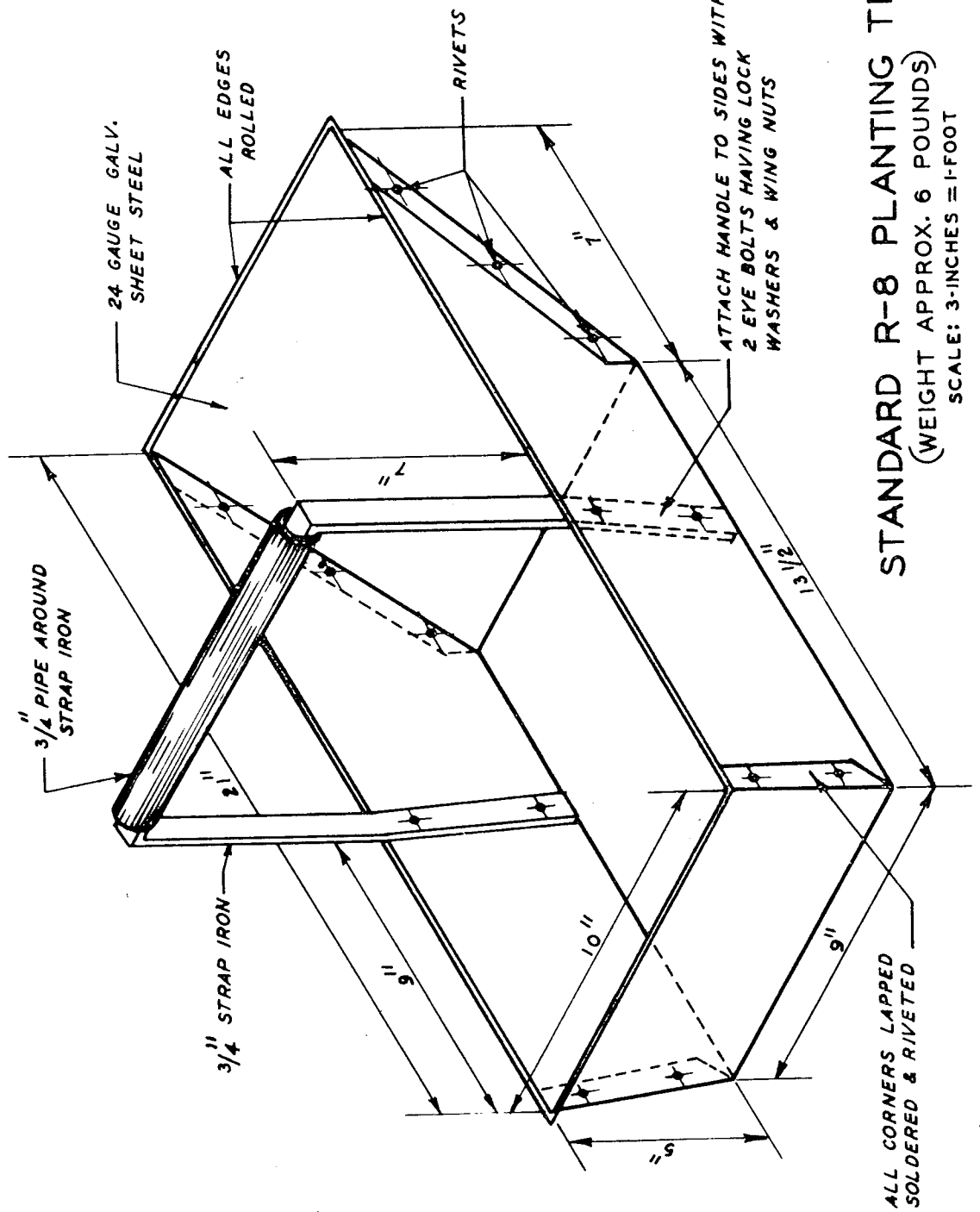
Plantation No.: _____

Species & Lot No.: _____

A - FIELD RECORD - ONE FOR EACH PLANTATION (One for Unit)

WINTER SECK. 19 _____

Date	Chr. No.	Type	Address	Item	N Trees	Planting	Transportation	Other	Current Total	Cumulative Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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33										
34										
35										



STANDARD R-8 PLANTING TRAY
 (WEIGHT APPROX. 6 POUNDS)
 SCALE: 3-INCHES = 1-FOOT

STANDARD PLANTING BAR REGION 8

CONSTRUCTION

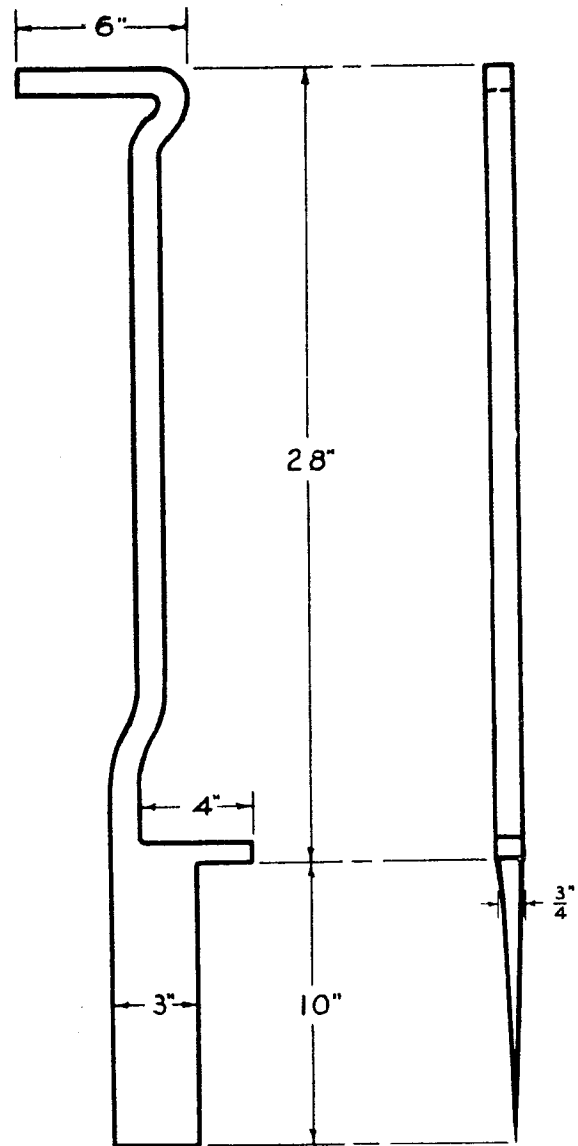
THE BLADE IS MADE OF HIGH CARBON TOOL STEEL FORGE WELDED TO SHAFT OF HEAVY TUBING. BLADE IS HAMMERED TO SHAPE, GROUND TO POINT & HEAT TREATED FOR HARD USE.

THE HANDLE IS ONE PIECE CONSTRUCTION.

SPECIFICATIONS

LENGTH OF BLADE = 10"
WIDTH = 3"
THICKNESS AT TOP = $\frac{3}{4}$ "
TAPERING TO POINT
OVERALL LENGTH = 38"

6/25/37



FRONT VIEW

SIDE VIEW

PLANTING TRAINING CAMPS

Introduction

The sole purpose of a planting training camp is to thoroughly familiarize those men who will later handle planting work with the technique of planting, the standards to be observed and the proper method of recording accomplishments. All supervisory personnel will be well grounded in the accepted methods of training others under their direction.

Training Camp Organization

Plans for all training camps will recognize the division of responsibilities of group members and vary the program to fit the needs. Planters will be taught to care for and plant trees; crew foremen to care for and plant trees, to train others, to supervise the work of their crews and to maintain the required records. Stockmen-timekeepers must know how to take care of planting stock upon receipt and to maintain all of the necessary records. There is no need to teach planters, for instance, what is expected of foremen or stockmen-timekeeper since they will have no need for such training. Likewise, crew members should not be given specific instruction in training others, but it is very important that crew foremen be drilled in this phase of their work.

It will be necessary, therefore, to conduct at least two planting camps, one for the crew foremen and other supervisory personnel, and a second for the planters. First, everything pertaining to planting, records and training methods should be covered; secondly, training in the mechanics and technique of planting, care of stock and other points on which the planters should be informed, will be covered.

The District Ranger is responsible for organizing and conducting all planting camps on his district. Assistance will be given him by members of the Supervisor's staff and others as needed, but this should not be interpreted to mean that the Ranger is not to take an active part in all camps.

Training Methods

Insofar as practicable, all training or instruction will be given on the job, that is, while the men are in the process of learning to do the work. Lectures will be kept to the absolute minimum in every instance and such sessions should be of short duration. Most of the instruction can be more effectively given by actually doing the job. Planting is manual work and as such can be

taught by the four-step method of instruction. Likewise, the completion of the daily records should be taught in the same way. The job is at hand, therefore, it is not necessary to assume a hypothetical condition. Instruction under actual conditions results in a more complete and thorough understanding of what is required.

It is presumed that all men who will conduct planting camps have a working knowledge of training methods, particularly in the use of the four-step procedure. Where this experience is lacking, it is the Supervisor's responsibility to see to it that assistance is given in the preparation and execution of training plans.

Typical jobs of a planting foreman are given below. Such jobs as safety, care of men, lunches, etc., are common to all work and are not included in this outline. Where special jobs arise in connection with planting work, they should be added to the list as part of the training for planting and taught to the foremen.

Planting Foreman - Typical Jobs:

- Job 1 - Get Stock, Men and tools.
- Job 2 - Organize Planting Crew.
- Job 3 - Instruct Planters.
- Job 4 - Inspect Planting Work.
- Job 5 - Report day's accomplishments.
- Job 6 - Supervise Planting Crew.

Instructions for stockmen-timekeeper, Project Superintendent and others assigned to caring for stock and maintaining camp records will cover the following jobs:

Stockman-Timekeeper

- Job 1 - Receive Stock.
- Job 2 - Care for stock in camp.
- Job 3 - Issue stock to foremen.
- Job 4 - Make weekly summary of work accomplished.
- Job 5 - Maintain camp planting cost records.

Junior Foresters, Project Superintendents, Foremen leaders and others assigned to the job of monumenting plantations and establishing stake rows will be taught the following jobs:

Job 1 - Establish plantation boundaries.

Job 2 - Establish stake rows.

All of the above jobs have been analyzed for training content and are given below. Conditions peculiar to a given planting job may require emphasis on different points or the addition of others. This may be done without confusion or revamping materially the outline as given:

Typical Foremen Jobs

Job 1. Get Stock, men and tools.

<u>Job Operations</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Get stock from stockmen-time-keeper.	1. Definition of stock lot number, where found, reason for them. Date stock received, how identified.
2. Pack in containers for transporting to the field.	2. Condition of stock, how inspected, What to do if not in good condition. Use of moss and water.
3. Load men, tools, and trees.	3. Safety regulations necessary, care of stock enroute.
4. Check to insure everything is at hand for day's work.	4. Completá crew, coats, lunches, tools, water, stock, etc.

Job 2. Organize Planting Crew.

<u>Job Operations</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Unloading, care of stock.	1. Safety regulations. Protect stock from weather, keep moist.
2. Fill planting trays.	2. Use of burlap, moss and water.
3. Separate the trees, protect stock from drying out or freezing.	3. Why separate the roots, amount of stock in each tray, when water is added and how.
4. Instruct tree packer.	4. Where to put day's supply of stock.

5. Care of stock.

5. When to water stock in planter's tray.

6. Water stock in trays.

6. How to carry stock to planters, when and why.

7. Carry stock to planters.
Miscellaneous jobs.

7. Care of coats, equipment and miscellaneous jobs.

Job 3. Instruct Planters.

Job Operations (What he does)

Operating or Information Points (What he needs to know)

1. Spacing to be used. Bar method.

1. Reason, how determined, deviations permitted.

2. Hold the tray in left hand, bar in right.

2. Reason for not reversing, how to hold both tools.

3. Placing the tray to commence work.

3. Reason for position of tray in relation to the planter.

4. Clean the spot of trash and grass with foot or bar.

4. Size, reason for keeping trash out of the hole, when to use the foot and when the bar.

5. Make the hole and prepare to plant the tree.

5. Position of the bar, depth of hole, why pull back slightly, where to put the bar when complete.

6. Plant the tree using the left hand.

6. Why hold the top with the left hand when inserting the roots, position of the roots, how to straighten them out, height of tree, definition of root collar, holding the tree in position for tamping.

7. Tamping the tree.

7. Why place at an angle and pull back then push forward; closing second hole, use of the bar, then the heel.

8. Rest periods.

8. When taken, smoking restriction. Care with matches and cigarettes.

Job 4. Inspect Planting Work.

<u>Job Operations</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Observe cleared space.	1. Size of space, position of tree in the opening.
2. Observe height.	2. Correct position of root collar with reference to ground line.
3. Observe surface tamping.	3. Top of slit closed, second hole closed, heel marks visible, top clear of soil, bud clear.
4. Dig up tree.	4. How lifted, care necessary, trash in the hole, position of roots, properly tamped, skinned root or stem.
5. Record information by individual crew member, inspection. Form F-1. Score Date Sign	5. Symbols for mistakes, crew member's name. When sample is selected, number selected. Importance of uniform inspection practice. Use of information when mistakes are found.
6. Show planter the mistakes found.	6. How to secure better planting through inspection work. Reason for poor work. What operation planter is slighting in planting. How to correct.

Job 5. Report Accomplishments for the Day.

<u>Job Operation</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Make out Form F-2. Date it.	1. When made out, how information is used. Need for accuracy.
2. Camp number entered.	2. Why needed.
3. Project designation.	3. Designation of project, how used.
4. Plantation number.	4. Reason for plantation number, what it is, why used, how determined. How to check for new plantation number on a new area.
5. Species and Lot number.	5. Why important. How mixed plantations are entered.

- | | |
|--------------------------------------|---|
| 6. Number trees planted. | 6. How determined. Reason for accuracy. How entered for mixed plantations. |
| 7. Number of men in crew. | 7. How determined, segregation needed. How data are used. |
| 8. Number planted per man day. | 8. How computed. |
| 9. Number of hours crew is in field. | 9. Principles to be observed in determining number of hours crew worked, entries to be made for part of day worked. |
| 10. Total man-days. | 10. How computed for crew; segregation to be observed and reasons. |
| 11. Submit form to timekeeper. | 11. When and where. |

Job 6. Supervise Planting Crews.

<u>Job Operation (What he does)</u>	<u>Operating or Information Points (What he needs to know)</u>
1. Use flag line.	1. Use of flags, how and where used, when moved, stair step formation to secure proper spacing.
2. Check spacing.	2. Deviations permitted. Natural reproduction, brush, etc.
3. Check stock in trays.	3. Amount stock on hand, condition as to water and protection by planters replacing burlap, quickest method.
4. Turn the crew.	4. Function of leader and crew members.
5. Place individuals in crew.	5. Why arranged from fast to slow, spacing arrangement, acceptable output.
6. Care for stock and tools at end of day's work.	6. Where left, how handled. Why trays are cleaned.
7. Mark the spot planting is to commence upon return to the plantation.	7. How to mark, why necessary. When to use it.

Typical Stockmen-Timekeeper Jobs

Job 1. Receive Stock.

<u>Job Operations</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Unload stock.	1. Care in unloading.
2. Separate into lots.	2. (a) How stock lots are marked. (b) Why stock lots are kept separate.
3. Date of receipt on bale.	3. How to date board.
4. Observe and note kind of damage.	4. Kinds of damage to be noted. What is damaged stock.
5. Note condition on nursery receipt.	5. What to put on receipt and where. Why nursery receipt is used.
6. Inform Project Superintendent.	6. When to inform Project Superintendent. Information to give him.
7. Return form to nursery.	7. When and how to return receipt.
8. Enter amount received and date on Form 19-M	8. Where and when to enter amount on Form 19-M. Importance of correct data.
9. Add to cumulative total (Form 19-M).	9. How to carry total forward. Responsibility for data.

Job 2. Care for Stock in Camp.

<u>Job Operations</u> (What he does)	<u>Operating or Information Points</u> (What he needs to know)
1. Put stock in beds or otherwise care for it.	1. When stock should be heeled in. How and why protected.
2. Separate old from new.	2. Why keep separate.
3. Mark date on stock.	3. Where to put stakes.
4. Make a trench.	4. How to make and prepare a trench.
5. Place stock in trench.	5. (a) How to handle stock. (b) How to protect stock during operation.

- | | |
|--|---|
| 6. Cover roots and tamp. | 6. (a) How deep to cover.
(b) Technique of tamping. |
| 7. Water stock. (Stock left in bales.) | 7. (a) When and how to water trees.
(b) How much water to use. |
| 8. Separate stock. | 8. (a) How to keep stock from heating.
(b) Amount of air space needed. |
| 9. Cover with canvas. | 9. When and how to cover. |
| 10. Water stock. | 10. (a) How to moisten stock in bale.
(b) How much water to use. |

Job 3. Issue Stock to Foremen.

Job Operations
(What he does)

Operating or Information Points
(What he needs to know)

- | | |
|--------------------------------------|--|
| 1. Give stock to foremen. | 1. (a) What stock to issue.
(b) How much to ship out. |
| 2. Record amount issued on Form 19-M | 2. (a) Where to enter date and amount on form for each foreman.
(b) How to record separately for each plantation. |
| 3. Balance Form 19-M. | 3. (a) How to add stock issued.
(b) How to determine amount of stock on hand.
(c) When to strike a balance. |
| 4. Inform Project Superintendent. | 4. (a) Why information is needed.
(b) What is done with it.
(c) Importance of accuracy. |

Job 4. Make Up Weekly Summary, Form P-3.

Job Operations
(What he does)

Operating or Information Points
(What he needs to know)

- | | |
|---|--|
| 1. Assemble Forms P-2 for week by crews. | 1. Number of crews working. |
| 2. Check <u>number of P-2 Forms</u> against record of days worked for each crew. | 2. Camp records maintained for this purpose. |
| 3. On a work sheet P-3 for each crew, enter P-2 separately showing data in Cols. 1 to 7, incl. | 3. How to add, divide and check results. |
| 4. Add columns 2, 5, 6 and 7. | 4. What constitutes reasonable production by crews in numbers planted, output per man day and working knowledge of crews as to size and personnel. |
| 5. Divide total of col. 7 by sum of 5 and 6, enter in col.8. | |
| 6. Divide total in col. 7 by sum of cols. 5 & 6. Enter in col. 9. | |
| 7. Enter totals from work sheet P-3 by crews on final P-3 (in duplicate). Total and average for camp. | 7. Number crews at work. |
| 8. Complete form by entering week ending date and camp number signed by Project Supt. | 8. Designation desired, period to be covered. |
| 9. Send original to District Ranger. | 9. When and where to send. |
| 10. File duplicate with P-3 attached. | 10. Where to file, reports to attach. |

Job 5. Maintain Camp Planting Cost Record.

<u>Job Operation (What he does)</u>	<u>Operating or Information Points (What he needs to know)</u>
1. Make up cost record for each plantation using Form 21-i.	1. (a) Number of plantations. (b) Designated number of each.
2. Enter cost data from camp Form 26 for each item.	2. (a) Elements of cost. (b) How subdivided. (c) Definition of each item. (d) How camp clerk compiles Form 26.
3. Enter number trees from 19-M for each plantation when complete or at designated intervals. Separate amounts by species in mixed plantations. Record M trees.	
4. Record date of entry in first column.	4. Date of purchase or obligation.
5. Enter to whom paid in second column.	5. (a) Name of party to whom payment is made. (b) How to enter payroll items from Form 26. (c) How to enter other items of cost from camp records. (d) How to enter transportation charges. (e) Where to obtain transportation costs in camp records.
6. Address of payee in end col.	6. (a) When to enter address, when not necessary. (b) What to enter when address is not given.
7. Describe item in fourth col.	7. Descriptive titles to be used for each entry or kind of entry.
8. Enter in the proper expansion column cost of item.	8. (a) How costs are classified. (b) Explanation of classification given on Form 134.
9. Add cost items and enter in current total.	9. When to add current costs.
10. Add current cost to previous costs and enter in cumulative column.	10. When to secure a cumulative total.
11. Forward to District Ranger at the close of the season.	11. When and where to send the completed record.

Typical Jobs for Establishing and Staking Plantations.

Job 1. Establish Plantation Boundaries

<u>Job Operations</u> <u>(What he does)</u>	<u>Operating or Information Points</u> <u>(What he needs to know)</u>
1. Set the corner posts.	1. (a) Where and why posts are set. (b) Where posts are needed, where omitted. (c) How deep to set the posts. (d) Why painted.
2. Scribe the plantation number, post number and date.	2. (a) How to use scribe. (b) Why posts are scribed. (c) Meaning of each entry.
3. Record location of posts and boundaries of plantation.	3. (a) Symbol to be used for posts and boundaries. (b) Why location of boundary important. (c) Accuracy desired. (d) How to use the same post for two plantations.

Job. 2. Establish Stake Rows.

<u>Job Operations</u> <u>(What he does)</u>	<u>Operating or Information Points</u> <u>(What he needs to know)</u>
1. Pick out the stake row location.	1. (a) Purpose of stake row. (b) Why all sites are staked. (c) Number of stakes to be used. (d) Direction of planting crews. (e) Length of rows, how to avoid short rows. (f) Principles to be observed in locating stake rows.
2. Number the stake row posts and commence staking trees across the plantation.	2. (a) How to scribe the corner posts which are also used for stake row posts. (b) Distance between staked trees. (c) Where to place the stake in relation to the tree. (d) Why staking should be uniform.
3. Mark every tenth stake.	3. (a) How stakes are marked. (b) How used in checking survival. (c) How to record.

4. Mark stake row across unplanted areas in the plantation.

5. Terminate the stake row.

6. Record number trees staked on 47-R7.

7. Send to District Ranger upon completion of the job.

8. Map and designate stake rows and stake row posts on plantation maps.

9. Color planted areas one color for each plantation.

10. Make out P-3 reporting the cost of monumenting and establishing stake rows.

4. (a) When to cross openings in the plantation and when to avoid them.
(b) How to designate the direction of the stake row across the area.
(c) Principles to be observed in the above operations.

5. (a) Where to end a stake row.
(b) When to use stake row post.
(c) How to end stake row when a post is not needed.
(d) Principles to be observed in determining where to end stake row.

6. (a) How to complete heading.
(b) Where to record numbered trees.

7. (a) When data are to be submitted.
(b) To whom sent.

8. (a) How mapped, legend to be used.
(b) How numbered and why.
(c) How stake row posts are shown on the map when coincident with the corner post. Scribing to be used.

9. (a) Colors to be used.
(b) Why plantations are designated by separate colors.
(c) How to do a neat job.

10. (Refer to previous lessons.)

The District Ranger or instructor responsible for the training camp has a definite job. Dependent upon the size of the job, certain assistance must be given in the actual training. Where the number of trainees varies from 15 to 25, two instructors are necessary. The ratio should be 1 instructor to every ten or twelve men.

Following is a list of the jobs an instructor must do in the execution of a planting training camp:

Foreman, Instructor and Trainer (D.R. Planting or Staffman)

- Job 1 - Select persons to be trained.
- Job 2 - Select jobs in which trainers will be trained.
- Job 3 - Analyze each job for training content.
- Job 4 - Determine training situation under which jobs will be best taught (Time, Place).
- Job 5 - Make arrangements of personnel and facilities. (Tools, trees, areas, meeting place, etc.)
- Job 6 - Teach four step method.
 - (a) Explain general planting situation and training method.
 - (b) Demonstrate four step method.
 - (c) Organize training pairs.
 - (d) Organize planting crew of foreman.
 - (e) Have each foreman direct training crew of foremen.
- Job 7 - Make schedule of training session.
(Typical training school schedule attached)
- Job 8 - Help foremen, Project Superintendent, organize enrollee training.
- Job 9 - Supervise Instruction by foremen of enrollee.
- Job 10 - Follow up on training at stated intervals.

Training Camp Schedules.

The following schedule is suggested in working out the procedure to be followed in organizing training camps. It will be noted that the instructor carries through the job of training, first by presenting the jobs to the foremen, demonstrating and explaining the work in detail. This is followed by the foremen doing the work themselves interspersed with sufficient conference to permit full discussions of all points. In effect, the camp is organized on the four-step procedure.

First Day

- 8:00 - 1. Assembly.
Short talk on objective of the meeting. Who are instructors. Outline to be followed. (Step I)
- 8:45 - 2. Organize foremen into planting crew with designated instructor for each crew.
- 9:15 - 3. Commence instruction by securing stock, proceed to planting area.
4. Instruct each foreman in planting in the field in the same manner you wish foremen to instruct planters. (Step II)
5. Practice planting by foremen. Each man to be proficient in the job before proceeding. Then have foremen practice planting in crew formation. (Step III)
- 4:00 - 1. Assemble for Conference.
Issue written instruction.
2. Explain four-step method of teaching, using the examples of the morning's work.

Second Day

- 8:00 - Organize planting crews into pairs. Each man is to act as an instructor. Take the foremen through the morning's work. Have each foreman practice teaching by the four-step method beginning by getting the stock and proceeding thus to the planting job in the field. (Step IV)
- 12:00- Organize into planting crews, each foreman to act as crew foreman. Instructor to teach individually each member of the crew. Jobs 4, 5, 6 at this time.
- 4:00 - Conference. Go over written instructions in detail. Assign each man to the job he is to do in planting. Duties and responsibilities of each man should be understood when the conference is finished.

Stockman-Timekeeper Training.

First Day

- 8:00 - Assemble stockmen-timekeepers, camp clerks and others in charge of transportation of stock, etc. Hand each the written instructions pertaining to his job. Have a complete set of forms for each man. Instructor demonstrates and explains how stock records are kept, care of stock. Issuing stock, summary records made up.
- 1:00 - Instructor makes out a planting cost record for at least three separate plantations. Have records for at least seven days at hand. Carry them through step by step, demonstrating and explaining each entry.
- 4:00 - Dispose of the records in accordance with the instructions.

Second Day

- 8:00 - Have members of camp receive and care for stock. Make out necessary records. Issue stock to foreman; make out records. Have a complete set of daily records for summarizing Form P-3. Have each man make out a P-3. Start and complete a camp planting cost record based on data, giving instructions step by step. (Check each man for correct entry.)
- 4:00 - Complete the record and dispose of it in accordance with the instructions.

Training Camp for Junior Foresters, Project Superintendents, Foremen and Others Engaged in Monumenting and Staking Plantations.

First Day

- 8:00 - Organize, and proceed to an established plantation. Small groups, five men or less. Demonstrate and explain every step to be observed. Take the class through the entire job
- 1:00 - Select the second area. Have each man monument and stake a part of the plantation. Each man to complete the records necessary.

Planters Training Camp.

Organize men into planting crews. Each foreman to train each man beginning with securing stock, loading trucks, filling the trays, following through with the planting, care of stock, care of tools, etc. Project Superintendent will assist in this work. Planters will not train each other as a time saving measure. Obviously men not proficient in planting and not understanding training methods can not do a proper job of instructing others in the crew. Where such a practice is permitted, more errors are passed on from one planter to another and in the end, the foremen have a larger training job in correcting a bad practice and teaching a new one.

Tree packers will be given special training for the jobs they are to do.

A limited number of crews will be trained at one time. The training of more than two crews simultaneously should not be attempted. It is much better to proceed slowly at the beginning of the season and build up than it is to start twice the number of crews without giving adequate assistance to the crew foreman. The project Superintendent or a well qualified foreman should assist each crew foreman in the training of his men for the first day.

All training of crew members will be by the four-step method with individual instruction, demonstration, practice and correction until the planters are proficient.