RESEARCH PROJECTS

UNIVERSITY OF IDAHO EXPERIMENTAL FOREST

5 IWW

Researcher Dr. Chi-Wu Wang, College of Forestry Date Nov. 29, 1971

Project Title Forest Genetics Experimental Plantations

(I) Inter-ecotypic hybridization and diallel crosses of Ponderosa pine

Objectives One experimental plantation concerning the hybridization and ten diallel crosses of Ponderosa pine(Pinus ponderosa).

Starting Date 1964 Duration Indefinite

Location NE 1/4, NE 1/4, NW 1/4, Sec. 26, T40N, R4W, BM(10 acres) See Plot 3 on attached map.

Funding Source MS#3

Additional Comments This project is very important as a long-range study.

RESEARCH PROJECTS

UNIVERSITY OF IDAHO EXPERIMENTAL FOREST

Date Nov. 29, 1971

Researcher Dr. Chi-Wu Wang, College of Forestry

Project Title Forest Genetics Experimental Plantations

(II) Geographic variations

Objectives Three experimental plantations of Ponderosa pine(Pinus ponderosa) are currently being studied to detect any differences due to geographic variation of seed origin.

Starting Date 1961 Duration Indefinite

Location Approx. NW 1/4, NE 1/4, Sec. 26, T 40N, R 4W, BM (22.5 acres) See Plot 1 on attached sheet.

Funding Source University of Idaho and MS #3.

Additional Comments None.

RESEARCH PROJECTS

UNIVERSITY OF IDAHO EXPERIMENTAL FOREST

Date Nov. 29, 1971

Researcher Dr. Chi-Wu Wang, College of Forestry

Project Title Forest Genetics Experimental Plantations

(III)Genetic studies of Western Larch.

Objectives (1.) One plantation studying the interspecific crosses of Western Larch and Japanese Larch.

(2.) One plantation studying provenance of Western Larch obtained from twelve seed sources from Idaho, Montana, Oregon, Washington, and Canada.

Starting Date 1961 Duration Indefinite

Location Approx. NW 1/4, NE 1/4, NE 1/4, Sec. 26, T 40N, R 4W, BM (7.5 acres) See Plot 2 on attached sheet.

Funding Source University of Idaho and MS #3.

Additional Comments None.

RESEARCH PROJECTS

UNIVERSITY OF IDAHO EXPERIMENTAL FOREST

Date Nov. 29, 1971

Researcher Dr. Chi-Wu Wang, College of Forestry

Project Title Forest Genetics Experimental Plantations

(IV) Progeny test of Ponderosa pine.

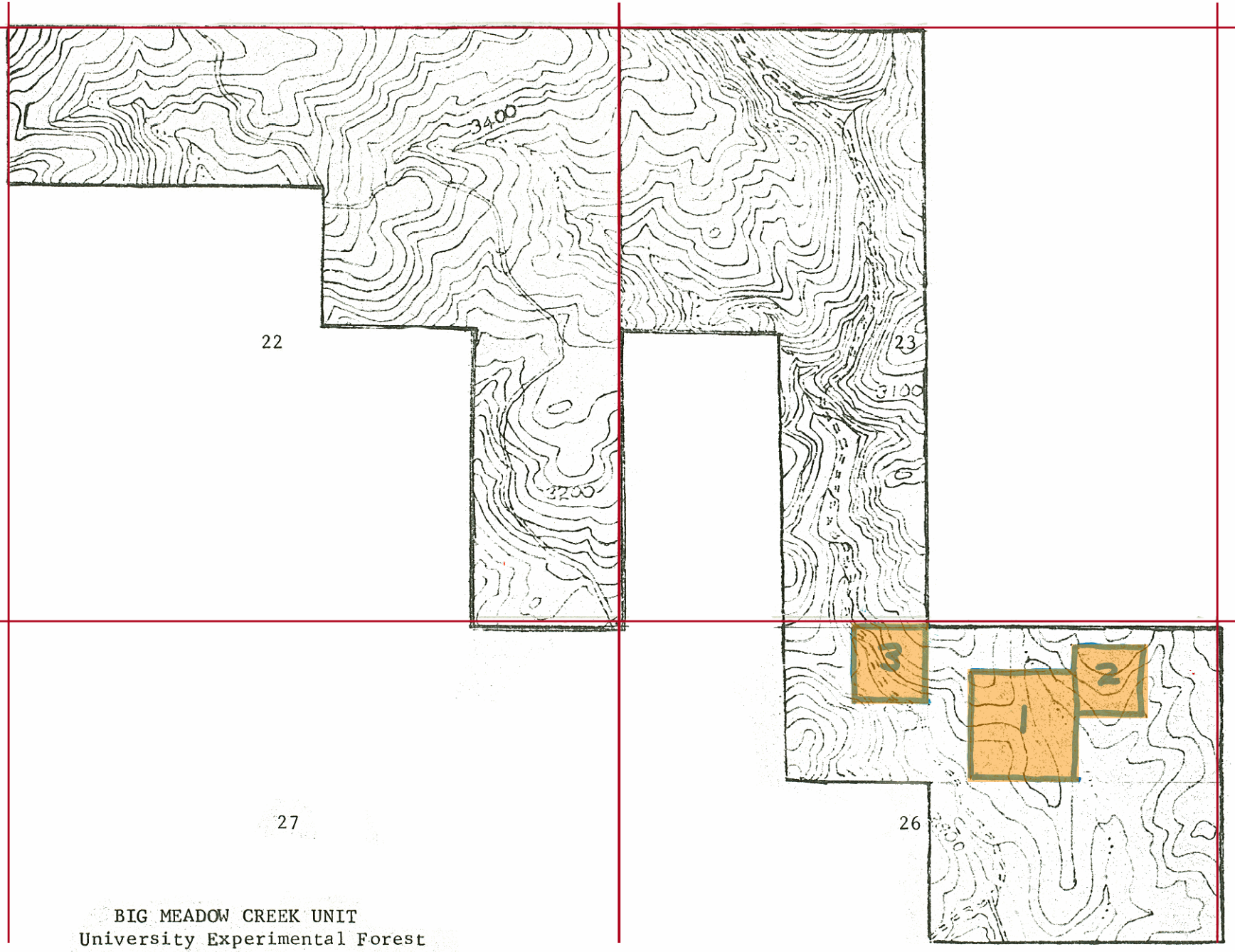
Objectives Progeny test of seed orchards of the co-operative Ponderosa pine(Pinus ponderosa) tree improvement program. Three plantations are currently being studied. These plantations aren't located on the experimental forest but should be included in this summary.

Starting Date 1964 Duration Indefinite

Location Two plantations are located at Heyburn Park(north of Moscow) and one plantation located at Tensed, Idaho.

Funding Source MS #3

Additional Comments This also is considered very important as a long-range study by Dr. Wang.



BIG MEADOW CREEK UNIT
University Experimental Forest
T40N,R4W,BM

THE COOPERATIVE

FOREST TREE IMPROVEMENT PROGRAM

COLLEGE OF FORESTRY, UNIVERSITY OF IDAHO

By: Chi-Wu WANG

Moscow, Idaho

December 1963

THE COOPERATIVE FOREST TREE IMPROVEMENT PROGRAM

COLLEGE OF FORESTRY, UNIVERSITY OF IDAHO

CONTENTS:

I. Initiation of the Cooperative Forest Tree Improvement Program

The Idaho Forest Tree Improvement Program was initiated in 1957 as a cooperative project of the Idaho State Forestry Department, Southern Idaho Forestry Association, U. S. Forest Service, and the University of Idaho.

The Committee on Super Tree Research, composed of Roger Guernsey, State Forestry Department (Chairman), Don Lynch, U. S. Forest Service, Ernest Wohletz, College of Forestry, University of Idaho, and Gordon Greenway, Southern Idaho Forestry Association, met in the office of the State Forester on January 11, 1957, for the purpose of developing a "plan for bringing a resident geneticist to Southern Idaho and for getting him started on developing "plus tree", with initial emphasis on the ponderosa pine."* The committee recommended that the project be started as soon as possible as a cooperative enterprise shared by the following: (1) College of Forestry, (2) Southern Idaho Forestry Association, (3) U.S. Forest Service, and (4) State Forestry Department. It was also recommended that consideration be given to establishment of a small experimental nursery and to procurement of a suitable site for a seed orchard. This should be at least 40 acres of the best soil.*

The cooperative agreement drafted by the cooperators in October 1, 1957, included the following:

1. The University is to engage and pay the full salary of a qualified forest geneticist and to give direct administrative supervision.

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*A report of the committee on Super Tree Research Meeting to Research Council, Southern Idaho Forestry Association.

2. The forest geneticist is to be placed in Boise at the Boise Research Center, a branch of the Intermountain Forest and Range Experiment Station, to operate full time on forest genetics research in southern Idaho.

3. The Intermountain Forest and Range Experiment Station is to appoint the forest geneticist as a collaborator without remuneration, and to furnish a vehicle for the official use of the forest geneticist.

4. The Southern Idaho Forestry Association and the Idaho State Division of Forestry agree to deposit the sum of $1850 each in a cooperative fund with the University, to be used for travel and operating expenses of the forest geneticist.

The following changes took place since 1960:

1. The Bureau of Land Management, Idaho, and U.S. Forest Service, Region One and Region Four, joined the cooperative project.

2. The Southern Idaho Forestry Association contributed the sum of $400 each year to be used for the project.

3. With the exception of the above, the financial support of this cooperative project was all from the University. The University added a special research fund (S.R. #77, progeny testing of ponderosa pine) to the regular forest genetics budget to defray the cost of progeny testing in southern Idaho.

4. The forest geneticist was placed in Moscow, Idaho, to teach forest genetics to graduate students and qualified upper class students. Four Ph.D. candidates were in residence in the fall semester of 1963, and conducting independent research under the supervision of the forest geneticist.

II. Progress of the Cooperative Forest Tree Improvement Program

The progress of the Cooperative Forest Tree Improvement Program for the period 1957-1959 was recorded in the Annual Reports of the Forest, Wildlife, and Range Experiment Station, College of Forestry, University of Idaho, 1957-59. Since 1960, the forest tree improvement program was concentrated in the following fields:

(A) Selection and Progeny test for the improvement of Ponderosa Pine.

This is generally known as the seed orchard or the "super tree" project. The work plan is outlined in the following schematic diagram (p.13). In essence the basic approach of the plan is the selection of superior parent materials as evaluated by the performance of their progenies. The early part of the program (Phases I & II) is a system of selective breeding within local population.

Selection is made from natural variants of a region. In Phase III, selection will be made among artificially created variants.

The initial step in a tree selection project is to define the objective of selection. A uniform tree scoring system for selected trees is to be adopted by all cooperators so that all tree selections were made according to a standardized system. A meeting of cooperators in 1960 was primarily devoted to this matter. All desirable qualities to be expected in tree improvement were examined. A simple and uniform tree scoring system was devised. The emphasis is on two factors which are growth vigor and superior tree form. The growth vigor reflects both physiological superiority in growth rate and general adaptability to the environment of an area for which the selection is made. In tree form selection stem, branch, and crown characters are considered. The objective of tree form selection is to improve the quantity of commercial timber production by quality improvement. An increase in quantity of commercial timber, and hence, an increase in the value of yield per unit area could be accomplished even if no great increase in actual quantity of wood could be expected because of limitation of site conditions. Wood samples will be obtained from selected trees. The specific gravity and fiber character of wood from selected trees will be examined.

SELECTED Tree:

Height (H s):_____ft. Age:_____
Volume (Vs):_____
Crown radius (Cs):_____

AVERAGE Trees:
(Average of 10 neighboring D & CD trees of the same age).

Height (H a):_____ft. Age:_____
Hd=H s-Ha
Volume (Va):_____
Crown radius (Ca):_____
Volume ratio (Rv)=$\frac{Vs}{Va}$_____
Ratio of crown areas (Rc)=$(\frac{Ca}{Cs})^2$___

TREE SCORE:

(1) Tree Form

Straightness (5,2,0):_____
Branch diam. (5,2,0):_____
Nat. Pruning (5,2,0):_____

(2) Tree Growth

Height Growth (H d) (5,2,0):_____
Volume Growth (Rv) (5,2,0):_____
Crown Area (Rc) (5,2,0):_____

The tree scoring system was field tested in 1961 by cooperators. It was found to be a simple system, practical for the field use and to give generally uniform results. Cooperators participated in the preparation of the tree scoring system including foresters from the State Forestry Department (Roger Guernsey, William Scribner, Jack Gillet,

Ray A. Miller), Intermountain Forest and Range Experiment Station (Marvin Foiles), Boise National Forest (Howard Alskog, Bruce V. Groves, Woodrow W. Doupe, LeRoy Sprague), Payette National Forest (Delmer F. Marsolek), Bureau of Land Management (Don Kobelin, Tom Schoder), and members of the Southern Idaho Forestry Association (Bert Cleaveland, George L. Crookham, Vern Gurnsey, George V. Hjort).

The tree scoring system designed for field evaluation of phenotypes of seed trees includes desirable characters considered as important for genetic tree improvement by our cooperators. However, it was realized that the effectiveness of a selection system (selection differential) decreases drastically with the increase in number of characteristics taken into consideration. The selection of seed trees in initial screening was not very rigorous. In general, practice seeds were collected from 10 of the best looking seed trees having superior height growth within an even-aged and fully stocked stand of phenotypically desirable trees. The selected seed trees usually represent approximately 2-5% of a stand.

The next year, 1962, was a moderately good seed year. Stands of phenotypically desirable trees were located for initial screening by progeny test. Two selected stands representing different elevations were located within each area wherever possible. Open pollinated seed from 10 of the best trees of the stand, no less than 100 feet from the nearest selected tree were collected. The cones were sent to Crookham's firm for kiln drying. Seed and cones characters were measured, and seedlings were raised in 1963 at U.S.F.S. Lucky Peak Nursery for progeny testing.

Until 1963, sixty-six selected stands were located seeds from 490 selected trees collected, 12,000 seedlings raised for the combination progeny test and seed orchards, and five progeny testing plantations established, vis.: #61-1 Heyburn Park, #61-2 Slaughterhouse Creek, #61-3 Granite Creek, #63-2 Meadow Creek and #63-3 Heyburn Park. The above work was accomplished through the enthusiastic collaboration of cooperators which makes the forest tree improvement project possible on a region-wide scale.

Now adequate materials have been assembled for the establishment of three 13-acre seed orchard to produce genetically improved seed of ponderosa pine for southern Idaho. The initial material is composed of progenies of 284 selected trees from southern Idaho. The plantation is designed as a combination parent-progeny test and seed orchard. Further improvement is expected by thinnings after selections are made between stands, between parent trees and within progeny from the initial 5' x 10' spacing to 50-100 trees per acre at seed production age.

It is recommended that three 13-acre seed orchards be planted in different sections of southern Idaho. For northern Idaho a similar

collection of materials for a model seed orchard (151 selected trees, 18 stands, 7 acres) were selected from a narrow belt between 47°-49° Lat. N., north of Moscow.

The work on selection and progeny tests is supported by a special research grant from the University of Idaho (Special Research #77 Progeny test of Ponderosa Pine). Additional funds are needed for operational expenses to establish seed orchards and originate further work related to Phases I - II of the Tree Improvement Program.

(B) Genetic Variation of Ponderosa Pine.

The genetic improvement of a forest tree is based upon an understanding of its genetic variation and population structure. For this reason, the genetic variation of ponderosa pine has been an important field of investigation since the beginning of the research program. This problem was investigated at three levels (1) genetic variation of ponderosa pine in Idaho, (2) genetic variation within a natural stand and, (3) genetic variation throughout its geographic range.

Genetic Variation of Ponderosa Pine in Idaho (#60-1, Moscow). This is an 8-replicate 10-tree plot experiment of 24 seed sources. It includes 7 seed sources from Boise Basin in addition to other Idaho seed sources. Observations include initiation and cessation of growth, frost hardiness, shoot-elongation over the entire growing season, and lemma and prolepsis growth.

Genetic Variation of Ponderosa Pine Within a Natural Stand (#61-2 Slaughterhouse Gulch, #61-3 Granite Creek). Progenies of 433 selected trees from an approximately forty acre natural stand near Centerville were field planted in two 7-replicate plantations by the State Forestry Department and the Boise National Forest near Idaho City. A similar plantation was made in H eyburn Park (#61-1). Unfortunately, the exact identity of most of the trees was not available. Seedling from known seed trees was raised and test planted in 1963, (plantations #63-2 Meadow Creek, 8-rep. and #63-3 Heyburn Park, 8-rep.). Ordinary seedlings from Idaho Ranger District (D-3) of Boise N ational Forest and Idaho County seed sources of the State Forestry Department were used for comparison. The purpose is for the evaluation of the selected trees by progeny testing and for comparison of performance of progeny of selected trees with the "run-of-the-mill" seedlings of the same general area. The geographic variation plantation (#63-1) Heyburn Park, was established in 1963. It includes 20 replicates in single tree plot of 157 seed sources throughout the natural range.

(C) Intra-specific hybridization.

Controlled pollination between individual trees of district morphological characters were made in 1961, 1962, and 1963 in Moscow, and in 1962 in Boise Basin. The purpose was to study the heritability of tree characters that have profound influence on timber quality and seedling survival. Among the characters considered are stem, branch and crown forms and cone and seed characters. The control-pollinations made included reciprocal crosses and selfings. Plastic casing was found to be most satisfactory as protective cover. Destruction of cones by insect and rodents remains to be a serious problem. Damage to 1962's pollination amounted to over 50% in some cases.

(D) Genetic Variation in Wood Characters.

The improvement of wood quality is one of the most important objectives of a tree improvement program. To study the genetic variation of wood characters in ponderosa pine of different geographic sources, wood core samples were obtained from the ponderosa pine racial variation plantation at the Priest River Experimental Forest. The characters examined were specific gravity and fiber length. Additional wood core samples were obtained from selected trees and other natural stands to study the genetic variation in ponderosa pine wood characters under natural conditions.

A study on the genetic variation in fiber character of western redcedar (Thuja plicata) was initiated and supported by a $3000 annual grant from the Intermountain Forest and Range Experiment Station of the U.S. Forest Service. This problem is investigated by a graduate student and Ph.D. candidate in Forest Genetics.

III. A WORK PLAN FOR THE COOPERATIVE FOREST TREE IMPROVEMENT PROGRAM*

The work plan for a forest tree improvement program is dictated primarily by the objective of improvement, and genetic characteristics of the tree species involved. The work plan for the cooperative forest tree improvement program as outlined in the schematic diagram presents the principle steps to be taken in their proper sequence. It consists of three phases in genetic improvement, viz.: (1) Initial screening, (2) Superior tree, and (3) Superior hybrid. Each succeeding phase leads to an increasingly higher level of genetic improvement. As to the actual scale of operation, although there is a minimum beyond which improvement work will be ineffective, the work plan devised for this program is readily adjustable to the intensity and rate of improvement anticipated and resources available.

However, there are two crucial features that are stressed in all phases of the program:

1. There is no seed produced in the seed orchard (grafted or seedling seed orchard) at any phase of the program that is not evaluated by progeny test. Progeny test is the only real proof of genetic improvement.

2. There is no waiting period of usually several years between the establishment of seed orchard and progeny testing. According to this plan progeny test is always made prior to seed production.

Objective of the Cooperative Forest Tree Improvement Program

The primary objective of the forest tree improvement program is for quantity production of quality timber. The desirable characters considered to be important in tree improvement as listed in the following, were thoroughly examined by the cooperators. It was agreed at the meetings of 1960 and 1961 in the preparation of selection criteria, that at the present stage priority be given to growth vigor and good tree form in tree selection.

In "A Guide for Finding Superior Ponderosa Pine Trees and Stands in Southwestern Idaho"** by the Research Committee of Southern Idaho Forestry Association, the following are listed as important factors that must be considered in selecting a plus tree: growth rate (fast diameter and height growth), crown form (narrow crown), limb form (small and short limb, wide branch angle, not more than 4 limbs per whorl), bole form (straight bole with little taper, good natural pruning ability), freedom from insects and diseases, and drought resistance.

Donald W. Lynch, Leader of Boise Research Center, Intermountain Forest and Range Experiment Station in a joint report with Marvin Foiles and Larry Inman, dated March 24, 1958, give their description of the desirable type of ponderosa pine tree for genetic improvement program, (1) good seedling survival, (2) good diameter and height growth and good wood quality, (3) resistance to diseases, (4) resistance to insects, (5) good tree form. If growth rate is not sacrificed in the process, they consider the ideal tree should have good form such as: (a) straight bole, (b) high bole/limb ratio (small limbs), (c) horizontal branching, (d) high form factor.

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*The above is the work plan that was followed since 1960, and will be followed to the degree that funds are available.

**Edward W. Smith, Elbert Cleaveland, and Donald W. Lynch (1957)--"A Guide for Finding Superior Pine Trees and Stands in Southwestern Idaho."

George V. Hjort believed that two kinds of ponderosa pine should be achieved in the genetic program, one which would survive on dry sites and another variety for less severe sites. (Memorandum to members of S. I. F. A. Research Committee and Forest Genetics Committee, March 28, 1958). He further suggested that "First of all there is some question in my mind whether or not it should be ponderosa pine only. It seems to me that Douglas fir and white fir should be included." This suggestion was discussed at the Forest Genetics Steering Committee of 1960, and agreed that with the progress of the tree improvement program, breeding of trees for higher elevations, dry sites, and special soil types should be considered. Other forest tree species will be added to the tree improvement program when needs arise and funds are available. The general approach of this work plan can be used in other forest tree species of this region.

Three Phases of Genetic Improvement

The work plan of the forest tree improvement program consists of a sequence of three phases of genetic improvement: phase I initial screening, phase II superior tree, and phase III superior hybrid. The two early phases are essentially a system of selective breeding. Parent materials best suited to local environment and improvement objectives are selected from natural variants: In phase III, selection is made from variants artificially created by intra-ecotypic, inter-ecotypic and if necessary inter-specific crosses.

Phase I Initial Screening. This is an initial step in selective breeding. The screening is to be made primarily in a 1-parent, single-tree progeny test of several hundred trees from the best natural stands throughout a general area. For southern Idaho 284 trees were selected from 35 natural stands. Open pollinated seeds were collected in 1962 by the U. S. Forest Service, Bureau of Land Management, Idaho State Forestry Department, Boise-Cascade Inc., University of Idaho and other cooperators. Each cone collection was kept separate by parent. Seedlings were raised at the Lucky Peak Nursery of the U. S. Forest Service in 1963 to be used in establishing a combined 1-parent progeny test and seed orchard.

The seed orchard will be planted at approximately 5 ft. X 10 ft. spacing or approximately 870 trees per acre. The field planting will follow a randomized block design of 4-tree plots with 10 replicates in each orchard. Each seed orchard will include 284 X 4 X 10 or 11,360 trees on 13.7 acres. Three seed orchards will be established in 1965 and 1966 in different parts of southern Idaho where ponderosa pine is used extensively for reforestation.

One of the most severe tests and the first selection of all the progenies will be the initial survival. Within the first year, initial mortality of 20-30% can be expected on a less severe site in a commercial planting with 2-0 seedlings of local origin. The initial survival rate will possibly reflect the "transplantability" of the different progenies under ordinary field planting conditions. In the first 10 years after planting, no selection and thinning shall be made except to reduce competion. During this period, evaluation of early progeny performance will be made. Selective thinning between selected stands, between parent trees and between individuals of the same progeny will be made in subsequent years according to progeny performance. The plantation eventually will be thinned to approximately 50 trees per acre (30' X 30' spacing) for production of proven genetically superior seed from the best trees of initial screening.

For two important reasons the initial selection was made between selected natural stands rather than among individual trees. The primary reason is that an even-aged, fully stocked, naturally regenerated stand is generally a better

and more reliable indicator of genetic constitution of the subpopulation than an isolated individual tree is of its own genetic characters. The radius of effective pollen dispersal for ponderosa pine can be reasonably assumed to be 300 to 400 ft. Natural seeding of pine has an even more restricted effective range. Hence an even-aged, natural stand can be considered as a progeny test stand of parent materials of the immediate neighborhood. The selection of natural stands as an initial step is essential in Idaho where great local physiographical diversities made individual tree selection especially ineffective.

The other reason for initial selection in natural stands is to provide practical consideration for early production of proven superior seed. Because trees of selected natural stands are of seed producing age, the best stands, as evidenced by superior performance of their selected trees, will be thinned and managed to produce seed for immediate use.

Phase II Superior Tree. Superior trees are selected from the best parent trees recognized from progeny tests in initial screening. The progeny tests also yield valuable information concerning whether the desirable characters, such as good tree form and high growth rate, are distributed at random throughout southern Idaho or are most likely to be found in certain areas. Based upon this information, further screening will be made in a similar manner as outlined in the last section. Two to three additional screenings will be made during the next ten years. Each screening will include approximately 300 to 500 trees from approximately 40 to 60 selected stands. (With the exception of a good seed year it is not always easy to obtain seed from all 10 best trees. It is better to collect only from the best rather than to include mediocreones or to wait for several years). Twenty to forty best parent trees from each of the initial screening will be selected to make up a total of approximately 100-120 trees to be included in the progeny test for superior trees.

The number of parent trees to be included in each field test is determined by the practical consideration of the size of field plantation that can be established under the present scale of operation (10-20 acres). It must be large enough to maintain the number of replicates sufficient to yield significant results. The number of trees included and size of field test plantations established can be readily adjusted to speed up the process of selective breeding when additional resources are available in subsequent years.

At the present level 100-120 best trees obtained in the series of initial screening will be replicated 20 times in the progeny test for superior tree. The large number of replicates is necessary for more rigorous selection between the progenies. The plot size will be 4 trees per plot. Fewer trees per plot are not advisable because of the high initial mortality rate. The large number of replicates necessary and the lack of uniformity in site condition make larger plots undesirable. The spacing of either 5' X 10' or 10' X 10' can be used. If 10' X 10' spacing is used, the seed orchard will be 18.4 acres in size including 100 X 20 X 4 or 8,000 trees. Because all the trees included in this plantation are best trees obtained in Phase I, they can be used for seed production without selection.

For further improvement of the initially screened materials, selection will be made in the progeny test of Phase II. The parent trees that produce the best progenies will be multiplied by grafted plants and seedlings for mass production of superior seed for the region.

Phase III Superior Hybrids. In this phase of genetic improvement superior hybrids are created by controlled crosses. Controlled crosses will be made between selected individuals of the same ecotype, between ecotypes and between species. Selection will then be made within the F_1, F_2 and back cross hybrids to obtain the best genetic combination.

This approach is adopted in the work plan as a means for further genetic improvement especially for those characters that are either not available in the local ecotype from which the selective breeding was made or adaptive characters which cannot be effectively improved by selection from local population. In the early part (phases I-II) of the tree improvement program local stands are used in initial screening. This is because our knowledge of silviculture and provenances of ponderosa indicates distinct ecotypic differentiation within this species. Improvement within the locally well adapted ecotype is always the best initial step. However, there is no reason to assume that all the desirable qualities of ponderosa pine deserving future genetic improvement are restricted to the four-county area from which the initial screening was made. Further genetic improvement can be made by introducing desirable qualities through controlled cross into the superior trees.

Furthermore, obtaining genetic improvement by selection from local population in adaptive characters such as drought resistence and seedling survival is generally not an effective approach in genetic improvement. It is futile to expect a few generation of artificial selection to provide substantial improvement in an adaptive character which is vital to the survival of the species and has been selected by nature for thousands of generations of this species. In genetic improvement works related to adaptive characters, it is desirable to include materials from non-local sources. For this reason, additional materials were obtained at the time of initial screening from peripheral areas. The non-local ecotypes will furnish valuable inheritance information and breeding materials for further improvement of ponderosa pine by controlled crosses.

Production of Genetically Superior Seed

Early production of genetically improved seed was a major consideration in devising the work plan. In order to accomplish this, the three phases of the work plan collectively form a continuous sequence for a long-range project, but separately each phase is an entity which has a definite objective of genetic improvement and a practical purpose. Improved seed are produced in phase I as well as in each of the succeeding phases. Each succeeding phase reaches an increasingly higher level of genetic improvement through more rigorous selection and breeding.

In phase I, genetically improved seeds are produced from two sources: (1) The progeny test plantation is planned from the beginning to be a combination progeny test and seed orchard. According to the performance of progenies, a series of selections will be made between the selected stands, between seed trees and within each progeny. The original plantation of approximately 870 trees (5' X 10' initial spacing) will be converted readily to a seed orchard of 50 to 100 trees per acre after a series of selective thinning in conjunction with progeny tests.

(2) On the basis of the above progeny test, genetically superior stands are distinguished from local populations. These stands will be thinned and managed to produce seed for immediate use. These stands are not ordinary "seed production areas" of phenotypically selected trees. The genetic superiority

of these stands has been evaluated by a fair sample of their components in a progeny test. Because trees of this stand are all full-grown and of prime seed production age, quantity production of improved seed is achieved years earlier than a grafted seed orchard augmented by a progeny test.

Seed produced in grafted seed orchard not augmented with progeny test is of doubtful quality and limited usefulness. In the national meeting of SAF (October 20, 1963, Boston) the question of certification of seed orchards was discussed. A subcommittee was appointed to consider the feasibility of developping minimum standards and models of progeny tests for the certification of seed orchards and seed production areas.

The best trees isolated in initial screening could be used temporarily for seed orchard purpose either by graftings or by seedlings. But they are not as intensively selected and are not from as broad genetic basis as materials from Phase II and III. The superior trees and superior hybrids developed in Phases II and III will be multiplied by vegetative means (grafting) and by seedling to establish seed orchards of enough acreage to meet the need of reforestation.

IV. RECOMMENDATIONS

(1) - Phase I

Three 13-acre seed orchards shall be established in three different parts of southern Idaho in 1965 and 1966. The parental materials were selected by cooperators of the Cooperative Tree Improvement Program in 1962, and the seedlings for seed orchard were raised by the Lucky Peak Nursery of the U.S. Forest Service, Region IV in 1963.

One of the seed orchard will be located in the vicinity of Idaho City and another one in McCall area. If cooperators are interested in establishing seed orchards on different soil types (granitic, basaltic), additional materials will be made available for a fourth seed orchard.

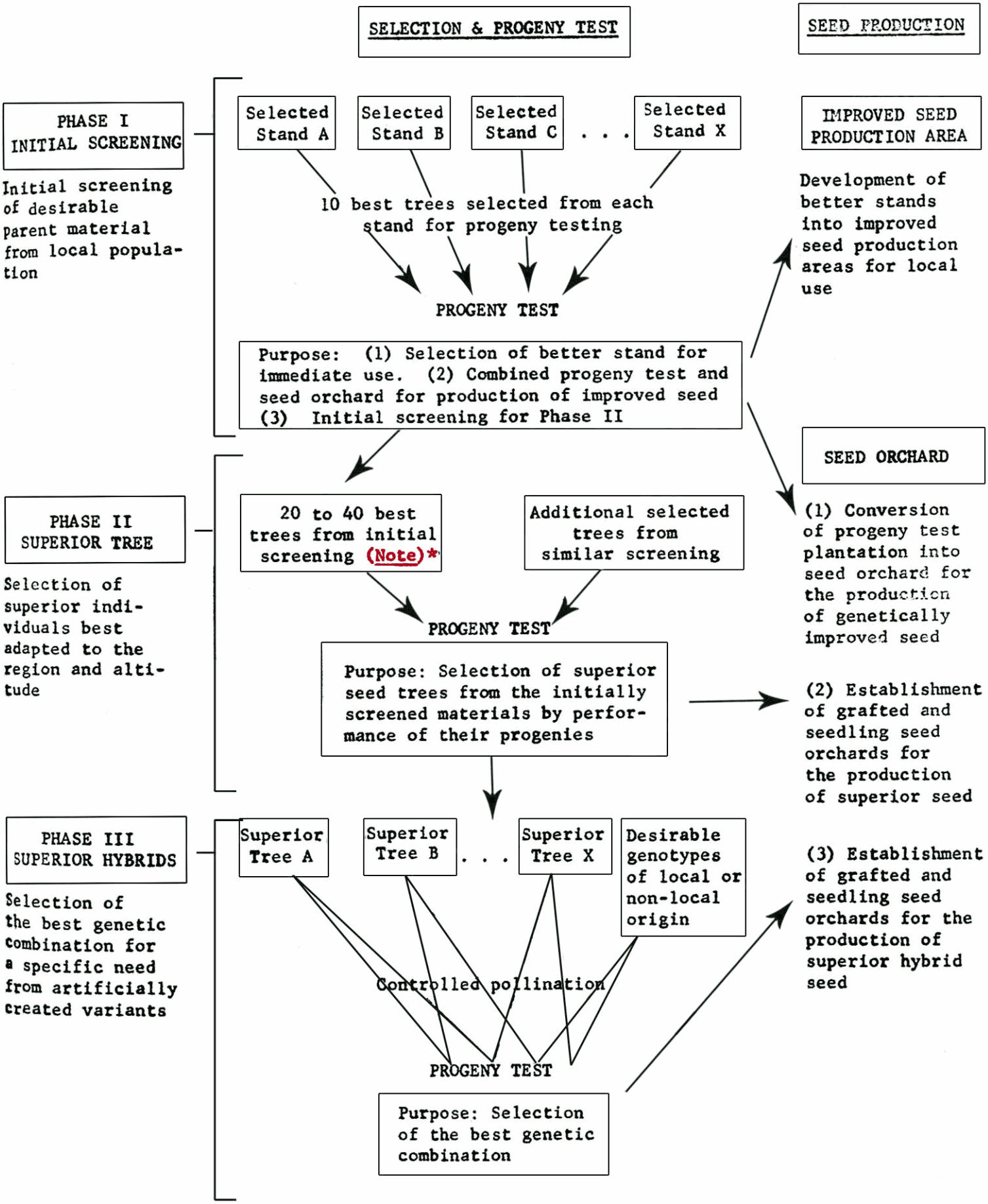
(2) - Phase II

(Superior Tree) of the Tree Improvement Program shall begin in 1964 if approved by cooperators. Detail procedures of this phase of the program will be discussed in the next meeting of cooperators. For additional screening, a 3-hour short course followed b y a field demonstration will be organized for field workers.

(3) A meeting of cooperators will be held this spring (spring 1964) to work out details concerning lay-out of seed orchard plantations, raising of seedlings and preparatory works related to the second phase of the program. It is recommended that each cooperator designate a "contact man" to participate in this and subsequent "work sessions" to discuss detail procedures of the work plan.

Chi-Wu Wang
December 1963
Moscow, Idaho

SCHEMATIC DIAGRAM OF A WORK PLAN FOR THE COOPERATIVE TREE IMPROVEMENT PROGRAM



*Note: Initially screened materials may be used temporarily for seed orchard purpose, but they are not as intensively selected and from as broad a genetic basis as materials in Phase II.

Location of Complete Research:

Author & Title: Wang, Chi-Wu (Ziwu)
The Cooperative Forest Tree Improvement Program

University of Idaho Library:

Call Number- IDAHO SD 399.5 W36 1963

College of Natural Resources:

Department- Forest Resources

Other Sources: