Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

STATION PAPER NO. 98
APRIL 1962

U.S. DEPT. OF AGRICULTURE
LIBRARY
MAY 8 - 1962
CURRENT SERIAL RECORDS

Proceedings of the Fifth Lake States Forest Tree Improvement Conference

LAKE STATES FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

FOREWORD

The Lake States Forest Experiment Station* has given active support to the Lake States Forest Tree Improvement Committee since the Committee's inception in 1953. In the interests of encouraging and coordinating forest genetics activities in this region, we are happy to publish this Proceedings of the Fifth Lake States Forest Tree Improvement Conference, as we did for the preceding four conferences.

M. B. Dickerman, Director

*Maintained by the Forest Service, U. S. Department of Agriculture, at St. Paul 1, Minn. in cooperation with the University of Minnesota.

PROCEEDINGS
of the
FIFTH LAKE STATES
FOREST TREE IMPROVEMENT
CONFERENCE

September 19 & 20, 1961

Station Paper No. 98
April 1962

Lake States Forest Experiment Station
Forest Service
U. S. Department of Agriculture

ACKNOWLEDGMENTS

The Fifth Lake States Forest Tree Improvement Conference was the culmination of the activities of the Lake States Forest Tree Improvement Committee for the past biennium. It presented two innovations as compared to past conferences: (1) The major part of the conference was held in the field, and (2) it provided the technical session for the Wisconsin-Michigan Section of the Society of American Foresters' fall meeting. This Proceedings makes a record of the conference available to all, and the Committee hereby extends its thanks to the Lake States Forest Experiment Station for publishing it.

A lot of work was involved in arranging and conducting this conference, and, on behalf of the Committee, I should like to thank all who helped in this undertaking. John Macon was in charge of arrangements. He was assisted by a number of people, notably the following: Hans Nienstaedt of the Lake States Forest Experiment Station, Charles E. Rieck of the Wisconsin Conservation Department, King Sheldon of the Rhinelander Paper Company, Paul Smith of Consolidated Water Power and Paper Co., and Edward Steigerwaldt, consulting forester. I want to express appreciation also to the officers and members of the Wisconsin-Michigan Section of the Society of American Foresters who joined with us in the best attended Lake States Forest Tree Improvement Conference yet held; to K. R. Butterfield, Supervisor of the Nicolet National Forest, who was master of ceremonies at the banquet; to Professor R. J. Parent of the University of Wisconsin who gave the banquet address, an illustrated talk on weather satellites; to those who participated in the technical program; and to those who came from other regions to meet with us. All contributed to the success of the conference.

Stephen H. Spurr, Chairman
Lake States Forest Tree Improvement Committee

CONTENTS

THE PRACTICAL POTENTIAL OF A REGIONAL FOREST TREE IMPROVEMENT PROGRAM

by William C. Bramble[1]

The basic aim of a tree improvement program, when stripped of its technical complexities, is to make available to the practicing forester better forest trees for producing forest crops that are currently available and, furthermore, to make this production possible with a minimum of losses owing to insects, disease, climatic damage, and failure to adapt to site conditions.

At the very beginning of a consideration of the practical potential of a forest tree improvement program we might ask, "Why do we need such a program at all?" Certainly, the figures that have been published on gross regional production of cubic feet of wood show that this should be adequate for some time to come, perhaps for the next 20 years, provided good forest management is carried out. There has been an estimate made that we will need an increase in production of about 50 percent to meet increased consumption, and that this 50 percent increase can be achieved through application of better forest management. Why then do we need a tree improvement program?

I would say we do so that we may get the help of new techniques of the type which can be obtained best through a tree improvement program. We need these to get assured production of the right species at the right time and in the right place. Regional inventory figures which yield gross cubic-foot figures for all species in all locations under all conditions that exist over a considerable area are usually misleading. Using such figures, for example, it can be shown that even a state like Indiana is producing more wood by far than is currently being used. However, when we consider the quality of the trees, their location in respect to markets and industry, and species requirements, we find that there is inadequate timber production in that state.

We have made considerable progress in the practical use of tree improvement to date. For example, genetics has aided in solving one of the earliest problems in silviculture, the choice of trees to leave as seed producers. For many years we have talked in silviculture of leaving superior trees as seed trees but have always given way to the so-called practical approach which is leaving trees that aren't suitable for harvest. I believe newer work in genetics has greatly strengthened our position in demanding that better trees be left as seed production agents for the future generation.

1/ Head, Department of Forestry and Conservation, Purdue University, Lafayette, Ind.

Although we have come a long way on this road, in practice it is still almost impossible to distinguish between internal defects that are hereditary and those that result from external environment and are not inherited. Potential resistance to insects and diseases is practically an untouched field, although variations in resistance are well known. We take the attitude that to be safe, and until definite information is available, leave only trees that appear good. However, we could use more information that will help us definitely distinguish hereditary defects and resistance from those caused by environment.

Back about 1934, Professor Schädelin in Switzerland published a concept of "Thinning as a selection and improvement system of highest value." This school of thought put thinning on a biological basis rather than on a mechanical or economic basis and emphasized that production of large amounts of high-quality timber could be done only by careful tending of the stands. This meant that individual selection for improvement of forest stands must be carried out through all the various stages of stand development, beginning with weeding the young growth, and proceeding through cleaning and thinnings into harvest of mature timber. While this has been carried out for a number of years by a few silviculturists, particularly in hardwood areas, the question still remains of how to assess a tree at an early age as to its probable quality at the time of harvest. This calls for better techniques in actual selection of individual trees and is where a forest tree improvement program can help.

Since the beginning of forestry in the United States we have had experience with the introduction of foreign species. Many of these were simply "shots in the dark" where such trees as Scotch pine, Corsican pine, and Austrian pine or hybrids between North American and European cottonwoods were brought into the country, tested briefly, and unfortunately used for widespread planting. To date, I would venture to say that introduction of exotic species into our country has been of dubious value to the practicing forester. It has produced some very expensive lessons such as that experienced by pulpwood companies in the East with hybrid poplars before they realized that they would be damaged by poplar canker.

However, I am optimistic enough to believe there is still a possibility of introducing exotic strains into certain regions of the United States. In a country like Brazil, for example, the exotic eucalyptus is the backbone of the charcoal and pulpwood industry, and other promising exotics have been tested, some to fail and others to look very promising. The fact that Brazil is a country with a wealth of species, even beyond that of the United States, leads me to believe that there is still a great deal to be gained by us through testing foreign species in a tree improvement program, particularly where extensive reforestation is involved.

It should be a practical part of a tree improvement program to carefully test and evaluate promising introductions. These tests must extend beyond the nursery rows or the controlled plots of the researcher and be introduced into field conditions in area plantings before any new trees are put into practical programs.

One of the most important contributions that tree improvement has made to forestry in this region is recognition of the importance of seed source in tree planting and reforestation. There are long-standing experiments in the Lake States that have yielded valuable information on this point. It has also been very impressive to read report after report on seed source tests over the country that almost invariably end with the statement that the local species or those from the nearest sources are best. I don't believe this will always be the case. As a matter of fact we have seen that this has not held true in certain regions and countries where exotic species have outperformed the local ones.

More recently techniques for selecting high-quality seed production areas have been emphasized through tree improvement programs. The value of collection of seed from high-quality stands has been an accepted theory for many years, but, unfortunately, even today it is not being followed owing to the pressure of expanded stock production and the consequent need for large quantities of seed by many nurseries. Sooner or later, however, one of the great contributions of a tree improvement program in this region will be acceptance and practical use of high-quality stands for seed production areas.

More recent developments in tree improvement programs have been in connection with breeding of selected, high-quality trees and the subsequent testing of the progeny or seeds produced by them. This is being done to develop improved races or strains from both exotic and native species, and has a great deal to offer if properly carried out and if regarded in its true light as a long-term project aimed to give a solid foundation for the future. I recall some time ago receiving a copy of the Wall Street Journal in which there was an article playing up the production of super-pines in the South. A note was attached to this article from the president of the university asking, "Why don't we do something like this?" My opinion at that time and now, too, is that this is not a crash-type of program that you rush into to get super-trees in the next few years, but it must be a long-term breeding and selection program that will have much to offer over a long haul if properly done. At that time, we were more properly interested in getting better stocking of forest stands with native species and improvement of production through better forest management than with tree breeding as a crash program.

To sum up the preceding analysis of practical applications of forest tree improvement, I believe the following potentials can be offered by a regional program:

1. We could get better information on how to select genetically desired seed trees and thus leave them, with more assurance that it is economic to do so. We should have better keys to internal quality in our selection of these trees than is currently possible.

2. We should be able to make a better selection of trees of potential high quality in young stands to favor in silvicultural operations.

3. We could through better testing of exotics prevent costly mistakes, and perhaps add some valuable species to our planting stock.

4. We could develop programs to select, locate, and maintain better seed sources from natural stands.

5. We could develop better strains of valuable species for future seed production in seed orchards.

6. We could develop disease and insect resistant trees. While this now is being done with some of our historically damaging diseases like the white pine blister rust and common insects like the white-pine weevil, a great deal more must be done. Help in reducing insect and disease damage is probably the most important potential of a forest tree improvement program.

I believe developing these potentials would lead to improved silvicultural management of our natural stands for higher yield and better quality, and make possible a more efficient planting program using better stock aimed for specific purposes. In other words, a tree improvement program can work towards producing the right species at the right place in the right time, and will, in the long run, help develop a better economic structure in our wood-using industries.

WHAT THE TREE IMPROVER CAN DO FOR THE PAPER MAKER[1/]

by R. C. Crain[2/]

The tree improver can make a substantial contribution to the pulp and paper industry by developing trees that will permit production of better paper at lower prices.

The pulp and paper industry uses a variety of woods for an even greater variety of products. The ideal requirements of cellulose fibers for these different grades vary widely, depending on whether the pulp is produced for making artificial silk or explosives or for paper and whether the paper is tissue paper or paperboard, absorbent or grease resistant, for printing or wrapping purposes, or for use in many special industrial applications. In all cases, however, lower cost is desirable, and this could result from tree improvement programs providing a greater growth rate or more wood per acre, trees with fewer branches and easy bark removal, trees that are insect and disease resistant, and, perhaps

1/ Dr. Crain did not prepare a written paper. This is a brief abstract of his remarks.

2/ Technical Director, Rhinelander Paper Company, Rhinelander, Wis.

less obviously, by wood from trees having low pitch or resin content, more cellulose and less lignin, and, particularly in hardwoods, longer fiber. Increase in wood density or decrease in lignin content would be almost directly reflected in lower pulp-and-paper raw material costs.

In addition to these rather obvious things many other advantages might develop from tree improvement programs, for one or more of the many different uses, if changes were produced in the fibers themselves. Greater fiber length is desirable by itself for some uses, as is a change in the ratio of length to diameter, or change in the cell-wall thickness. Change in the chemical structure of the outer cell walls could make the resulting pulp easier to hydrate or easier to maintain absorbency. Changes in the cell-wall structure could increase fiber strength. Changes in the lignin could make it easier to remove or more useful after removal. By appropriate selection and blending almost any of these changes which were reproducible with reasonable uniformity could be used to advantage in the manufacture of pulp and paper.

Even a 5-percent increase in wood density and a 2- or 3-percent decrease in lignin content would be a substantial contribution to the paper industry. Such developments would enable paper mills to produce better quality paper at less cost to the consumer. The paper industry will, however, find good use for whatever new trees are developed by genetics or silvicultural research.

Considerable detailed information giving wood requirements for different purposes is being developed and publications in this field should be noted. As a starting point the report appearing in the November 1960 TAPPI Magazine should be read. This is a report of the Forest Biology Committee of the Technical Association of the Pulp & Paper Industry.

REPORT OF THE SEED CERTIFICATION SUBCOMMITTEE

by W. H. Brener[1/] and Paul O. Rudolf[2/]

During the past biennium the principal activity of our regional subcommittee has been to cooperate with the Society of American Foresters' Seed Certification Subcommittee in a national survey of opinion on tree seed certification and legislation. We canvassed our own membership and prepared a composite questionnaire reply to the SAF Subcommittee.

Some 123 organizations or individuals received the SAF Subcommittee questionnaire and 96 replies were received, distributed regionally as follows: Northeast, 12; Midwest, 23; West, 25; South, 25; and Canada, 11.

1/ Chairman, Seed Certification Subcommittee, and member of the Wisconsin Conservation Department, Wisconsin Rapids, Wis.

2/ Chairman, SAF Seed Certification Subcommittee, and Research Forester, Lake States Forest Experiment Station, St. Paul 1, Minn.

Based on the information in the questionnaires and other pertinent material the SAF Subcommittee prepared a report that was published in the September 1961 issue of the Journal of Forestry (pp. 656-661).

The report suggested some revised minimum standards for certifying forest tree seed; these have been submitted to the International Crop Improvement Association for consideration. The report also suggested that action to obtain federal or state legislation on tree seeds be withheld until foresters become better informed and can present well-founded views on the subject. This recommendation was presented to the Association of American Seed Control Officials at their 1961 biennial meeting in New York. That organization referred the matter to their Tree Seed Committee, and they will make no recommendations before 1963.

The SAF Seed Certification Subcommittee turned up the fact that many foresters, even those engaged in seed work, are poorly informed or misinformed on seed legislation. The Subcommittee, therefore, is assembling information with which to prepare and disseminate widely a factual statement on tree seed legislation. The Subcommittee also plans to prepare two or three other brief factual statements concerning scientific evidence for using seed of known origin, explaining how certification might remove the risks from seed buying, what its probable costs would be, and how it might be implemented. These will be recommended for publication consecutively in the Journal of Forestry and then probably will be followed by another opinion survey to guide recommendations to seed certification and seed legislation organizations.

To get back to the local scene, the Tree Seed Certification Subcommittee of the Lake States Forest Tree Improvement Committee will continue to cooperate with the SAF Subcommittee. It also plans a closer survey of the tree seed legislation needs in the Lake States. It may, if the need seems evident, prepare guidelines for such legislation.

REPORT OF THE SUBCOMMITTEE ON RESEARCH EVALUATION, COORDINATION, AND PLANNING

by Paul O. Rudolf[1/]

The Committee on Forest Tree Improvement of the Society of American Foresters is preparing an annotated directory to the United States workers in forest genetics and related fields. It will compare with a similar directory to Canadian and foreign workers that was published in the Journal of Forestry for August 1960 (pp. 602-618).

Our Subcommittee assembled information for the workers in the Lake States. It will be consolidated with similar information from other parts of the country to form the national directory. Because there may be some advantage in having a separate regional directory we are presenting the alphabetical list of research workers in forest genetics and related fields in the Lake States and the Dakotas (Exhibit I), and a list of specialties, with the workers involved in each (Exhibit II). The Subcommittee will welcome information concerning any corrections or additions that should be made to this list.

1/ Chairman of the RECAP Subcommittee and Research Forester, Lake States Forest Experiment Station, St. Paul 1, Minn.

Exhibit I.--Alphabetical list of research workers in forest genetics and related fields in the Lake States and the Dakotas

	Name and title	Address	Specialties[1/]
1.	Ahlgren, C. E. Resident Director	Quetico-Superior Wilderness Research Center, Ely, Minn.	IE--*Picea*, *Pinus*, *Pseudotsuga*, *Larix*, *Tsuga*; VG; VP--*Pinus*, *Abies*; DR--*Pinus*
2.	Alden, Howard, Research Assistant	School of Natural Resources, Univ. of Mich., Ann Arbor, Mich.	VA--*Populus*
3.	Anderson, G. W., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., St. Paul 1, Minn.	DR--*Pinus*
4.	Anderson, N. A. Asst. Professor	Dept. of Plant Pathology and Botany, Univ. of Minn., St. Paul 1, Minn.	DR--*Pinus*
5.	Anderson, R. L. Plant Pathologist	U. S. Forest Serv., Lake States Forest Expt. Sta., St. Paul 1, Minn.	DR--*Pinus*
6.	Andresen, J. W., Asst. Professor	Dept. of Forestry, Mich. State Univ., East Lansing, Mich.	PR, TA, VA--*Pinus*
7.	Arbogast, Carl, Jr., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Marquette, Mich.	SC--General, VA--*Picea*, PR--*Pinus*

1/ See Exhibit II for explanation of subject-matter symbols.

	Name and title	Address	Specialties[1/]
8.	Arend, J. L., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., East Lansing, Mich.	SC--General, PR--Pinus, Larix
9.	Benson, Miles K., Research Assistant	Biology Group, Forest Genetics, The Institute of Paper Chemistry, Appleton, Wis.	NT, SE, ST, VC, VG, VP--Populus, PR--Larix
10.	Bean, J. L., Entomologist	U. S. Forest Serv., Lake States Forest Expt. Sta., St. Paul 1, Minn.	CP--Picea
11.	Berbee, J. G., Asst. Professor	Dept. of Plant Pathology, Univ. of Wis., Madison 6, Wis.	ST, CT, CV--Populus
12.	Berklund, B. L., Forester	Nekoosa-Edwards Paper Co., Port Edwards, Wis.	PR--Picea, Pinus
13.	Blake, G. M., Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	EX--Pinus, FR--Populus, VP--Tilia
14.	Buckman, R. E., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Grand Rapids, Minn.	PR--Pinus, SC--General
15.	Clausen, K. E., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Rhinelander, Wis.	HN--Betula
16.	Collins, P. E., Assoc. Professor	South Dakota State College, Brookings, S. Dak.	HY, VP--Ulmus, PR--Fraxinus, IE--General
17.	Cromell, W. H., Instructor	North Central School of Agr., Univ. of Minn., Grand Rapids, Minn.	VP--Picea
18.	Duncan, D. R., Professor	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	CT--Populus, PR--Picea
19.	Einspahr, D. W., Research Associate	Biology Group, Forest Genetics, The Institute of Paper Chemistry, Appleton, Wis.	BW, GG, HE, PQ, SE, ST; WQ--Pinus, Populus; PR--Larix, Populus; BH, BM, CP, CS, CT, CV, EX, FE, FL, FO, GR, HG, HN, HP, HS, IE, IN, MU, NT, PH, PL, PS, RA, SC, SF, TE, VC, VG, VP--Populus
20.	French, D. W., Assoc. Professor	Dept. of Plant Pathology and Botany, Univ. of Minn., St. Paul 1, Minn.	PR--Pinus, DR--Picea, Pinus, Populus, Ulmus

1/ See Exhibit II for explanation of subject-matter symbols.

	Name and title	Address	Specialties[1/]
21.	Garrett, Peter, Research Assistant	School of Natural Resources, Univ. of Mich., Ann Arbor, Mich.	VA--Populus
22.	Godman, R. M., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Cadillac, Mich.	FE, SA, SO--Pinus
23.	Goddard, D. W., Nurseryman-Forester	Rhinelander Paper Co., Rhinelander, Wis.	NT, SA, SO--Picea, Pinus
24.	Hiller, Charlotte, Technologist	U. S. Forest Serv., Forest Products Laboratory, Madison 5, Wis.	WQ--Fraxinus
25.	Hill, R. B., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Rhinelander, Wis.	HR, PR--Pinus
26.	Hitt, R. G., Asst. Professor	Dept. of Genetics, Univ. of Wis., Madison 6, Wis.	FL--Pinus, ST--General, IN, FR, VP, PO, PR, SI, SA--Pinus, SO--General
27.	Hoag, D. G., Asst. Professor	Dept. of Horticulture, North Dakota Agricultural College, Fargo, N. Dak.	VA, VG--Juniperus
28.	Hodson, A. C., Professor	Dept. of Entomology and Economic Zoology, Univ. of Minn., St. Paul 1, Minn.	IR, PR--Pinus
29.	Johnson, A. G., Instructor	Horticulture Dept., Univ. of Minn., St. Paul 1, Minn.	HG--Populus, IE--General
30.	Jensen, R. A., Asst. Scientist	School of Forestry, Univ. of Minn., Cloquet, Minn.	PR, VA--Pinus
31.	Kaufert, F. H., Director	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	CT--Populus
32.	King, J. P., Teaching Assistant	Dept. of Forestry, Mich. State Univ., East Lansing, Mich.	VA--Pinus
33.	Kozlowski, T. T., Professor	Dept. of Forestry and Wildlife Mgt., Univ. of Wis., Madison 6, Wis.	HA, PS, TR--Pinus
34.	Klein, Jerome, Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	SI, HY--Populus, Pinus

1/ See Exhibit II for explanation of subject-matter symbols.

	Name and title	Address	Specialties[1]
35.	Kuntz, J. E., Assoc. Professor	Dept. of Plant Pathology, Univ. of Wis., Madison 6, Wis.	DR--*Acer*, *Quercus*
36.	Kurmis, Vilis, Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	VA, FR--*Pinus*
37.	Larson, P. R., Plant Physiologist	U. S. Forest Serv., Lake States Forest Expt. Sta., Rhinelander, Wis.	GR, TR, PS--*Pinus*, *Picea*; VA--*Picea*
38.	Lassen, L. E., Technologist	U. S. Forest Serv., Forest Products Laboratory, Madison 5, Wis.	WQ, PQ--*Fraxinus*, *Populus*
39.	Latimer, M. J., Forester	Blandin Paper Co., Grand Rapids, Minn.	SA--*Picea*, ST--*Picea*, *Populus*
39a.	McMahan, R. J. Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	CY, MU--*Pinus*
40.	Mathes, Martin, Research Aide	Biology Group, Forest Genetics, The Institute of Paper Chemistry, Appleton, Wis.	CY, IN, PS, VP--*Populus*
41.	Macon, J. W., Forester	Consolidated Water Power and Paper Co., Rhinelander, Wis.	ST--*Picea*
41a.	Mohn, C. A. Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	PS, SC--*Tilia*
42.	Nagel, C. M., Professor	South Dakota State College, Brookings, S. Dak.	DR--*Populus*
43.	Nienstaedt, H., Geneticist	U. S. Forest Serv., Lake States Forest Expt. Sta., Rhinelander, Wis.	IE--General; CT--*Picea*, *Acer*; GG--General; GI, HA, HG, HN, HS, HY, PC, PH, PR, SE, SS, ST, TE, TR, VA, VG--*Picea*, *Pinus*
44.	Patton, R. F., Assoc. Professor	Dept. of Plant Pathology, Univ. of Wis., Madison 6, Wis.	DR--*Pinus*
45.	Pauley, S. S., Professor	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	IE--General; PR, VA--*Larix*, *Picea*, *Pinus*, *Populus*; HY, TR--*Populus*
46.	Pillow, M. Y., Supervisory Tech.	U. S. Forest Serv., Forest Products Laboratory, Madison 5, Wis.	PQ, WQ--*Pinus*, *Fraxinus*, *Populus*
47.	Prielipp, D. O., Forest Pathologist	Kimberly-Clark of Michigan, Inc., Iron Mountain, Mich.	CT--*Populus*, SO--*Picea*

1/ See Exhibit II for explanation of subject-matter symbols.

	Name and title	Address	Specialties[1/]
48.	Pronin, D., Technologist	U. S. Forest Serv., Forest Products Laboratory, Madison 5, Wis.	PQ, WQ--Populus
49.	Riker, A. J., Professor	Dept. of Plant Pathology, Univ. of Wis., Madison 6, Wis.	DR, ST--Juniperus, Pinus Quercus
50.	Ruby, J. L., Research Assistant	Dept. of Forestry, Mich. State Univ., East Lansing, Mich.	HE--Pinus
51.	Rudolf, P. O., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., St. Paul 1, Minn.	IE--General; HP--Pinus; PR--Picea, Pinus, Larix; SA, SC, SL, SS, ST--General
52.	Rudolph, T. D., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Rhinelander, Wis.	PR, VA--Pinus
53.	Schoenike, R. E., Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	RA--Pinus, VA--Pinus, Larix
54.	Slabaugh, P. E., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., Bottineau, N. Dak.	IE, SC--General, PR--Picea, Larix, Pinus
55.	Smalley, E. B., Asst. Professor	Dept. of Plant Pathology, Univ. of Wis., Madison 6, Wis.	DR--Ulmus
56.	Spurr, S. H., Professor	School of Natural Resources, Univ. of Mich., Ann Arbor, Mich.	PR--Larix, Pinus; VA--Populus
57.	Stewart, D. M., Plant Pathologist	U. S. Agricultural Research Serv., Plant Pest Control Branch, St. Paul 1, Minn.	PE--Picea, Pinus
58.	Sucoff, E. I., Asst. Professor	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	FE, FR, PS--General
59.	Trygg, P. Manager, Land & Timber Dept.	Diamond Match Div., Diamond National Corp., Cloquet, Minn.	VG, CV--Populus
60.	Wahlgren, H. E., Project Technologist	U. S. Forest Serv., Forest Products Laboratory, Madison 5, Wis.	PQ, WQ--Pinus, Populus
61.	Watt, R. F., Research Forester	U. S. Forest Serv., Lake States Forest Expt. Sta., St. Paul 1, Minn.	NT--Picea, Pinus; FE--Picea
62.	Wells, O. O., Research Assistant	Dept. of Forestry, Mich. State Univ., East Lansing, Mich.	TA, VA--Pinus

1/ See Exhibit II for explanation of subject-matter symbols.

	Name and title	Address	Specialties[1]
63.	Wilson, L. F., Entomologist	U. S. Forest Serv., Lake States Forest Expt. Sta., East Lansing, Mich.	CP, FE--Pinus
64.	Winton, Lawson, Research Assistant	School of Forestry, Univ. of Minn., St. Paul 1, Minn.	HN, FL, PL--Picea
65.	Wright, J. W., Assoc. Professor	Dept. of Forestry, Mich. State Univ., East Lansing, Mich.	HG--Acer, Fraxinus, Picea, Pinus; PR--Fraxinus, Pinus; HE, GG--General
66.	Zahner, R., Assoc. Professor	School of Natural Resources, Univ. of Mich., Ann Arbor, Mich.	PR--Pinus, VA--Populus

1/ See Exhibit II for explanation of subject-matter symbols.

Exhibit II.--Explanation of subject-matter symbols and workers involved in each specialty

Symbol	Meaning of symbol	Workers involved[1]
BH	Variation and inheritance of branching habit, including size, angle, number, and persistence of branches.	19
BM	Breeding, general; and breeding methods.	19
BW	Variation and inheritance of yield or properties of bark and wood extractives.	19
CP	Cone or fruit insects and diseases, control of birds and animals in seed production areas or orchards.	10, 19, 63
CT	Clonal testing, tree shows.	11, 18, 19, 31, 43, 47
CS	Control of pests in processed seed, or in seed and seedlings in the nursery or field plantings.	19
CV	Clonal variation, general.	11, 19, 59
CY	Cytogenetics and cytology, chromosome number, chromosome staining, and chromosomal aspects of crossability.	39a, 40

1/ These are numerical references to workers listed in Exhibit I.

Symbol	Meaning of symbol	Workers involved[1/]
DR	Variation and inheritance of disease resistance, including physiology or mechanisms of resistance and physiologic races of pathogens.	1, 3, 4, 5, 20, 35, 42, 44, 49, 55
EX	Experimental design, nursery and field sampling of wild or planted test materials.	13, 19
FE	Forest tree fertilization and nutrition, including mineral deficiencies.	19, 22, 58, 61, 63
FL	Floral biology, especially in relation to controlled pollination or breeding procedures.	19, 26, 64
FO	Variation and inheritance of foliage characters, including morphology, color, biochemistry, etc.	19
FR	Variation and inheritance of fruiting or fruitfulness and seed yield or set, including climatic influences.	13, 26, 36, 58
GG	General forest genetics, including educational and administrative aspects, libraries, translations, directories, bibliographies, herbaria, arboreta, etc.	19, 43, 65
GI	Genetical improvement of natural stands.	43
GR	Variation and inheritance of growth rate or increment, including growth efficiency.	19, 37
HA	Variation, inheritance, and testing of winter, frost, or cold hardiness.	33, 43
HE	Statistical genetics, including narrow or broad sense heritability, combining ability, parent-progeny correlations, dominance, epistacy, etc.	19, 50, 65
HG	Hybridization, interspecific and intergeneric.	19, 29, 43, 65
HN	Hybridization, natural, including introgression and hybrid swarms.	15, 19, 43, 64
HP	Hybrid performance, including hybrid interplantings.	19, 51
HR	Variation and inheritance of drought, heat, and salt resistance.	25
HS	Hybridization, intraspecific and intraracial.	19, 43
HY	Hybridization and hybridity, general, including crossability patterns, determination of hybridity, interspecific incompatibility, and heterosis or hybrid vigor.	16, 34, 43, 45

1/ These are numerical references to workers listed in Exhibit I.

Symbol	Meaning of symbol	Workers involved[1/]
IE	Introduction (acclimatization) and performance of exotics or breeding materials of exotic origin.	1, 16, 19, 29, 43, 45, 51, 54
IN	Flower induction in reproductively immature trees, photoperiodic, chemical, mechanical, etc.	19, 26, 40
IR	Variation and inheritance of insect or animal resistance.	28
MU	Mutation, mutation rates and induced mutation, including chimeras and sports.	19, 39a
NT	Nursery and transplanting, technology.	9, 19, 23, 61
PC	Controlled pollination technique.	43
PE	Pollen handling, including collection, extraction, forcing, storage, purity, and germination.	53, 57
PH	Phenology, general, or in relation to seed set, time of pollination and seed collection, cross- or self-ability, and insect, disease, or frost injury.	19, 43
PL	Polyploidy, natural and induced.	19, 64
PO	Pollen and pollen grain studies, general, including pollen morphology, tube growth and metabolism, and paleobotanical aspects.	26
PQ	Variation and inheritance of pulping qualities, including cell length and strength, fibril angle, density, etc.	19, 38, 46, 48, 60
PR	Provenience (Provenance) studies.	6, 7, 8, 9, 12, 14, 16, 18, 19, 20, 25, 26, 28, 30, 43, 45, 51, 52, 54, 56, 65, 66
PS	Basic physiologic studies in growth or growth efficiency, metabolism, water relations, auxin relations, apical dominance, topophysis, etc.	19, 33, 37, 40, 41a, 58
RA	Distribution or range studies concerning varieties, species, or other taxa.	19, 53
SA	Seed production areas, in improved natural stands.	22, 23, 26, 39, 51
SC	Seed collection, extraction, storage, variability and soundness tests, seed crop periodicity and forecasting.	7, 8, 14, 19, 41a, 51, 54

1/ These are numerical references to workers listed in Exhibit I.

Symbol	Meaning of symbol	Workers involved[1/]
SE	Selection, general, including methods and techniques, selection indices, juvenile-mature tree growth, or other relations affecting efficiency of selection.	9, 19, 43
SF	Variation and inheritance of bole or stem form, forking, crook, sweep, straightness, etc.	19
SI	Self-incompatibility and -compatibility, self-infertility and -fertility, selective fertilization, inbreeding depression, albinism, etc.	26, 34
SL	Seed, stock, tree, and clone registration laws, regulations and certification, including planting zones and plus and elite tree or stand registration.	51
SO	Seed orchard technology in planted orchards, including spacing, shaping, pollen contamination, etc.	22, 23, 26, 47
SS	Selection, stands.	43, 51
ST	Selection, single trees and mass selection.	9, 11, 19, 26, 39, 41, 43, 49, 51
TA	Taxonomy, including cytotaxonomy, varietal testing and identification, and botanical nomenclature.	6, 62
TE	Progeny testing, including theoretical considerations, one- and two-parent tests, polycrossing and diallel crossing, etc.	19, 43
TR	Tropisms, including photoperiodisms, thermoperiodisms, etc., and basic studies.	33, 37, 43, 45
VA	Variation, general, basic studies in clinal or ecotypic variation, including edaphic, climatic, geographic, etc., variation.	2, 6, 7, 21, 27, 30, 32, 36, 37, 43, 45, 52, 53, 56, 62, 66
VC	Vegetative propagation by cuttings, layers, leaf bundles, or leaves.	9, 19
VG	Vegetative propagation, by grafting or budding.	1, 9, 19, 27, 43, 59
VP	Vegetative propagation, general, including basic studies on origin of roots, stock-scion relations, etc.	1, 9, 13, 16, 17, 19, 26, 40, 45
WQ	Variation and inheritance of wood qualities, including strength and other properties, wood anatomy.	19, 24, 38, 46, 48, 60

1/ These are numerical references to workers listed in Exhibit I.

LAKE STATES FOREST TREE IMPROVEMENT COMMITTEE AFFAIRS

by Paul O. Rudolf[1/]

Members of the Lake States Forest Tree Improvement Committee serve 4-year overlapping terms. At each biennial conference the terms of half the members are completed, and an equal number of new appointments or reappointments are made. At this time a new Chairman and Vice-Chairman also are elected. The Executive Secretary serves a continuing term.

At the close of the Rhinelander conference, Committee officers, membership, and Subcommittee assignments were as follows:

Name	Address	Appointed through:	Subcommittee assignment
F. J. Hodge (Chairman)	Forestry Division Michigan Conservation Dept. Lansing, Mich.	1963	Seed Certification
Scott S. Pauley (Vice-Chairman)	School of Forestry University of Minnesota St. Paul 1, Minn.	1963	RECAP
Paul O. Rudolf (Exec. Secretary)	Lake States Forest Expt. Sta. St. Paul Campus University of Minnesota St. Paul 1, Minn.	1965	RECAP (Chairman), Seed Certification
W. H. Brener	Griffith State Nursery Wisconsin Rapids, Wis.	1965	Seed Certification (Chairman)
Dean Einspahr	Institute of Paper Chemistry Appleton, Wis.	1963	RECAP
D. W. French	Dept. of Plant Pathology and Agricultural Botany University of Minnesota St. Paul 1, Minn.	1963	Seed Certification
Emil G. Kukachka	Division of Forestry Minnesota Conservation Dept. St. Paul 1, Minn.	1965	Seed Certification
E. N. Lee	U. S. Forest Service 710 North Sixth Street Milwaukee 3, Wis.	1963	Seed Certification

1/ Executive Secretary, Lake States Forest Tree Improvement Committee.

Name	Address	Appointed through:	Subcommittee assignment
H. L. Mitchell	Forest Products Laboratory Madison 5, Wis.	1963	RECAP
R. F. Patton	Department of Plant Pathology University of Wisconsin Madison 6, Wis.	1965	RECAP
Don O. Prielipp	Kimberly-Clark Corporation Woodlands Division Norway, Mich.	1965	Seed Certification
Donald W. Renlund	Supervisor, Forest Pest Control Wisconsin Conservation Dept. Route 3 Madison 5, Wis.	1963	Seed Certification
Stephen H. Spurr	School of Natural Resources University of Michigan Ann Arbor, Mich.	1965	RECAP
Jonathan W. Wright	Department of Forestry Michigan State University East Lansing, Mich.	1965	RECAP

Plans for Next Regional Conference

The next biennial conference will take place in 1963. This will mark a decade's activity by the Committee. In the normal order of rotation this conference should be held in Minnesota, and that is the plan. Scott S. Pauley, as Vice-Chairman of the Lake States Forest Tree Improvement Committee, will be responsible for planning and arranging for the Sixth Lake States Forest Tree Improvement Conference. He will be assisted by other members of the Committee.

Newsletter

The Lake States Forest Tree Improvement Committee issues a newsletter, "Trebredinews" at irregular intervals, but about once a year between the regional conferences. The newsletter includes brief reports of the status of tree improvement work among agencies in the Lake States, information on recent or forthcoming regional conferences and news of tree improvement interest from other regions and countries. Each issue is prepared and distributed by one of the member agencies of the Lake States Forest Tree Improvement Committee. The most recent issues were distributed in February 1960 and February 1961.

RESOLUTION ADOPTED AT THE

FIFTH LAKE STATES FOREST TREE IMPROVEMENT CONFERENCE

Meeting Jointly with the

WISCONSIN-MICHIGAN SECTION SOCIETY OF AMERICAN FORESTERS

It is resolved that the members of the Fifth Lake States Forest Tree Improvement Conference and the Wisconsin-Michigan Section of the Society of American Foresters unanimously express a vote of thanks and appreciation to the following:

John W. Macon of the Consolidated Water Power & Paper Company for the overall responsibility of getting this joint meeting operational;

Hans Nienstaedt of the Northern Institute of Forest Genetics for arranging the field trips;

King Sheldon of the Rhinelander Paper Company for local arrangements of food and shelter;

Charles E. Rieck of the Wisconsin Conservation Department who assumed responsibility of registration for the meeting and to his female assistants generously provided by the Rhinelander Chamber of Commerce;

Paul Smith and Edward Steigerwaldt for their arrangement of the "spontaneous entertainment" and to the following companies, all of which contributed the essential essence for such entertainment: Owens-Illinois Glass Company, The Nelson Company, Kimberly-Clark, Inc., Connor Lumber and Land Company, Rhinelander Paper Company, and the Nekoosa-Edwards Paper Company; the elected officers of the Lake States Forest Tree Improvement Committee, Steve Spurr and John Macon, and the Wisconsin-Michigan Section of the Society of American Foresters, Don Mackie, Bob Patton, and Bernie Stout, who have contributed their services the past 2 years; and especially to Paul O. Rudolf, Executive Secretary of the Lake States Forest Tree Improvement Committee, who, with skill and foresight and a loyalty and patience far beyond the call of duty, has guided the activities of this organization since its inception 8 years ago.

Rhinelander, Wisconsin
September 19, 1961

F. J. Hodge
E. N. Lee
S. S. Pauley, Chairman,
Resolutions Committee

CONFERENCE BANQUET

On the evening of September 19, the conference banquet was held at the Shorewood Vista Resort, headquarters for the Fifth Lake States Forest Tree Improvement Conference. The efficient and entertaining master of ceremonies was Ken Butterfield, Supervisor of the Nicolet National Forest. The feature of the evening program was a highly interesting illustrated talk by Robert J. Parent, Professor of Electrical Engineering and Director of the Electrical Standards and Instrumentation Laboratory at the University of Wisconsin. The title of his paper was "The Use of Earth Satellites for Weather Forecasting." Those at the meeting gained some understanding of "weather satellites:" how they look, how they are constructed, and how they function.

FIELD STOPS ON THE PROGRAM OF THE FIFTH LAKE STATES FOREST TREE IMPROVEMENT CONFERENCE

The Fifth Lake States Forest Tree Improvement Conference differed from its predecessors in that the major part was spent in the field. During the 2-day meeting, half a day was spent in indoor sessions and $1\frac{1}{2}$ days in the field.

Most of the field stops represented tree improvement activities of some of the member agencies in the Lake States Forest Tree Improvement Committee. One or more representatives of the respective agencies acted as tour guides at each stop. In the following pages we give pertinent facts presented by the tour guides.

The Northern Institute of Forest Genetics

Tour Guides: Hans Nienstaedt and Staff[1/]

The Northern Institute of Forest Genetics was established at Rhinelander, Wis., in 1957. The Institute is a field office of the Lake States Forest Experiment Station, whose headquarters are maintained in St. Paul, Minn., in cooperation with the University of Minnesota. It is one of three genetics institutes established by the U. S. Forest Service in the United States. The other two are at Placerville, Calif. (Western), and Gulfport, Miss. (Southern).

1/ Staff members assisting were Philip R. Larson, Physiologist; Thomas D. Rudolph, Research Forester; Robert B. Hill, Research Forester; Kenneth Kessler, Plant Pathologist; and Richard Peters, Propagator.

The major purpose of the research underway and planned at the Northern Institute is to clarify the basic genetic and associated physiological processes of northern trees and the factors that determine their resistance to diseases, insects, drought, frost, and other major enemies. The practical objective is to improve the heritable quality of planting stock of the northern conifer and hardwood species. Currently the Institute has 30 active formal research projects in phenology, physiology of flowering, effect of growth substances, variation and selection, inheritance of characteristics, tree breeding, and vegetative propagation. There are also a number of informal or exploratory studies underway, including one on radiation effects on trees.

The Institute is ideally located for its experimental work. Immediately adjacent to it is the Hugo Sauer Nursery, operated by the Wisconsin Conservation Department in cooperation with the U. S. Forest Service and producing 7 to 9 million young trees each year for forest planting. It offers excellent facilities for observing early survival and growth of experimental stock, and most of the stock used by the Institute is grown there.

Through interested cooperators, all the forests of the Lake States, regardless of ownership, provide a source of material from trees with superior or unusual characteristics. Outplanting areas for progeny tests have been reserved in all of the National Forests of the region, including the adjacent Nicolet and Chequamegon National Forests.

The Institute occupies a new 8,000-square-foot laboratory building. This building has space and equipment for an eventual staff of 10 scientists. It includes four controlled-environment rooms, an excellent library where literature on tree genetics and physiology is being assembled, and adequate offices. Facilities are available for tissue culture and auxin bioassays. Pollen is handled in specially constructed rooms with temperature and humidity control.

Supplementing this main building is a modern, fully automatic greenhouse covering 2,400 square feet, and an attached headhouse and office laboratory. Nearby is sufficient lath house and coldframe space for present needs.

Results of studies, as they become available, are reported by the Lake States Forest Experiment Station in a series of Technical Notes and Station Papers. More comprehensive reports are published in scientific and professional journals or as special bulletins.

Between 1957, when the Institute was established, and September 1961, about 30 technical and more than a dozen nontechnical articles were published on the work of the Institute. Copies of these and of other reports by the Station staff may be obtained by writing to the Director, Lake States Forest Experiment Station, St. Paul Campus, University of Minnesota, St. Paul 1, Minn.

Institute of Paper Chemistry Field Trials on the Ripco Industrial Forest

Field Guides: Dean W. Einspahr, Miles K. Benson, and Martin C. Mathes[1/]

The Institute of Paper Chemistry has several field plots on the Ripco Industrial Forest of the Rhinelander Paper Company near Eagle River, Wis. These plots include trials of some larch species and hybrids, and field tests of various aspen polyploids, hybrids, and other selected material.

Exploratory Studies in Larch

There has been renewed interest in larch as a source of rapidly growing pulpwood. The fast growth of certain larch species and hybrids (especially *Larix eurolepis*) has been widely recognized, and polyploidy in larch is also an approach that looks promising. The materials planted in this area are part of a preliminary trial established to acquaint us with the proper methods of handling larch seedlings, check the suitability of several species of larch for use in this area of Wisconsin, and serve as a source of material for future experimental work with larch. Two additional larch species trials were established this past spring employing eight additional sources of material.

Early survival has been very good and height growth quite promising for the five lots planted here (table 1). The trees listed as Dunkeld hybrid larch (*Larix eurolepis*) Trailside No. 9 are seedlings obtained from Dave Cook[2/] as 2-0 stock in 1957. He collected the seed from one of the Dunkeld hybrids growing on the Cooxrox Forest in New York. The trees were field-planted in 1957. The other four sources of larch listed below were also obtained from Dave Cook and planted out as 2-2 stock in 1958.

1. S-1894--*Larix decidua* var. *polonica* from Kroscienko Forest District, Pieniny Mt., Poland, elevation 2,300 feet.

2. S-1887--*Larix decidua* from Paternion, Austria, elevation 2,130 feet.

3. Kurile Dahurian larch selection--*Larix gmelini* var. *japonica* from a plantation in Central Hokkaido, elevation 1,500-1,650 feet.

4. S-357--Kurile Dahurian larch selection--*Larix gmelini* var. *japonica* from a plantation in Central Hokkaido, elevation 1,500-1,650 feet.

1/ Respectively Research Associate, Research Assistant, and Research Aide, The Institute of Paper Chemistry, Appleton, Wis.

2/ A forester with the New York Conservation Department and a grower of larch in his own right.

Table 1.--Height and survival--Ripco larch measurements, fall 1960

Species	Selection	Survival	Average height
		Percent	Feet
Dunkeld larch	Trailside No. 9	90	5.5
Polish larch	SL-1894	98	5.8
European larch	SL-1887	100	3.7
Kurile Dahurian larch	S-357	100	6.2
Kurile Dahurian larch	*L. gmelini* var. *japonica*	100	6.2

Comparison of Several Aspen Hybrids

During 1959 a series of crosses was made between native aspens (bigtooth and quaking aspens) and *Populus alba*, *P. tremula* var. *davidiana*, and *P. sieboldi*. Our interest in these crosses included possible resistance to *Napicladium tremulae* and *Hypoxylon pruinatum* and their general suitability in the Lake States. None of the materials used as test trees in this trial, with the exception of XA-G-22-59, demonstrated exceptional growth in the year they were grown in the nursery.

Despite these results, it seemed desirable that this material be tested further because of the multiple interests involved. Consequently Experimental Trial XII was established in the spring of 1960 as a 3-replicate, randomized block design, employing 36 trees per plot. A 9x9-foot spacing was maintained, and growth measurements are to be confined to the interior 16 trees, with the outer 20 trees serving as border trees. Four of the eight types of test materials had enough additional test trees for the establishment of another replication.

Table 2 provides growth and survival information on Experimental Trial XII. All materials planted in this trial were root-pruned and cut back to a height of 12 to 14 inches when the trees were lifted prior to field planting. Again XA-G-22-59, which attained a height of 3.2 feet from seed in 1 year in the nursery, had the best average height after the first year in the field.

Table 2.--First-year growth and survival in Experimental Trial XII

Parent species (all *Populus*)		Cross no.	Average height 1960	Survival, 1960
Seed parent	Pollen parent			
			Feet	Percent
P. tremuloides	*P. tremuloides*	XT-9-59 (Control)	2.6	98
Do.	*P. sieboldi*	XT-S-29-59	2.4	92
Do.	*P. tremula* var. *davidiana*	XT-DA-30-59	2.8	98
P. alba	*P. grandidentata*	XA-G-22-59	3.8	92
P. tremuloides	*P. tremula* var. *davidiana*	XT-DA-18-59	2.8	100
P. grandidentata	do.	XG-DA-26-59	2.7	98
Do.	*P. alba*	XG-A-5-57	2.8	92
P. tremula var. *davidiana*	(Open pollinated)	DA-4-59	2.5	98

Comparison of Natural and Artificially Produced

Triploids with Diploid Control Trees

Experimental Trial X was established in the spring of 1959 to compare growth and general field performance of several sources of triploid aspen with each other and with selected diploids. The trial has an additional objective of checking the feasibility of a so-called "root sucker" method of establishing experimental materials. This method involves planting the experimental trees at a wide spacing (9x9 feet), treating the area to control weeds, and then cutting back the trees after 2 or 3 years' growth to induce root suckering. The objective of such a procedure is the production of a high-density stand which would be less prone to insect damage and could be established with the expenditure of a minimum amount of experimental material.

The experimental material involved in this trial included root sprouts from two natural triploid trees (T-160 and T-2-56); triploid seedlings from two crosses between northern sources of diploid quaking aspen and tetraploid *P. tremula* from Sweden (XT-TA-10-58 and XT-TA-14-58); diploid seedlings from a cross between two quaking aspen of average form and rate of growth (XT-12-58); and seedlings from an open pollinated seed source near the Ripco Experimental Farm. The planting stock used in this experimental trial had been grown 1 year in the nursery and was 18 to 24 inches in height when lifted and cut back to 12 to 14 inches prior to field planting.

A four-replicate, randomized block design was employed. Each plot contained 16 test trees planted at a 9x9-foot spacing. A single row of border trees was placed around the entire trial and between each plot in the trial. The objective of the border trees was to reduce border effects and reduce mixing of root suckers from adjoining experimental plots. Table 3 presents first and second year survival and growth information on this trial.

Table 3.--Growth and survival in Experimental Trial X

Kind of material	Lot number	Average height		Survival	
		1959	1960	1959	1960
		Feet	Feet	Percent	Percent
Interspecies cross	XT-TA-10-58	3.2	5.2	98	100
Interspecies cross	XT-12-58	3.8	6.2	100	100
Interspecies cross	XT-TA-14-58	3.4	5.8	100	100
Open-pollinated	T-66A-57	3.2	5.4	98	100
Root sprouts	T-160	2.8	5.2	100	97
Root sprouts	T-2-56	2.8	4.9	97	100

Comparison of Performance

of Selected Materials on Contrasting Sites

Experimental Trial XI was established in the spring of 1959 and consists of field plantings located at the Kimberly-Clark test area near Marenisco, Mich; the Cornell test area near Cornucopia, Wis.; and the Ripco Experimental Farm near Eagle River, Wis. The objective of this study was to test the reaction of selected materials to contrasting environments (including climate, soils, and vegetation). The importance of this type of approach has become increasingly evident because of the practical information such testing provides regarding the adaptability of improved materials.

As a preliminary approach to this problem, three types of test materials were planted in three locations that differ considerably in climate and soils. Vegetative competition also varied from heavy on the Kimberly-Clark test area to light on the Ripco Experimental Farm. The three test materials used were widely divergent in their origin as indicated on the following page.

1. T-36-56--Root sprouts of a natural triploid quaking aspen found in Upper Michigan.

2. XT-TA-14-58--Seedlings from a cross between a diploid *Populus tremuloides* and a tetraploid *P. tremula*.

3. XT-G-13-58--A hybrid between *P. tremuloides* and *P. grandidentata*.

This experimental trial, of which a single replication is represented here, was established with what might be called 1-0 stock. In the fall of 1960, after two growing seasons, the survival of the test trees was 100 percent, and XT-TA-14-58 averaged 5.9 feet, T-36-56 averaged 5.2 feet, and XT-G-13-58 averaged 3.6 feet in height.

The University of Wisconsin

Forest Tree Improvement Research Plots

Starks, Wisconsin

Tour Guide: Robert G. Hitt[1]

The plots at Starks are one of several tree improvement outplanting areas established by the University of Wisconsin. Represented here are seed source plantings of Scotch pine, pine field grafting trials, and unusual forms of red pine.

Scotch Pine Seed Source Study

The University of Wisconsin in cooperation with the Wisconsin Conservation Department has undertaken a number of small-scale provenience trials with Scotch pine. The seed used in these trials was obtained by personal contact from forest genetics research centers, was collected from normal and plus stands in Europe, and is all open-pollinated. The sources do not sample the species' range completely, but they represent a north-south transect through the western part of the range from southern Spain to northern Scandinavia (table 1).

The trial at Starks was established in the spring of 1957 with 2-2 stock. A 5x6 rectangular lattice design was used. Trees were planted on a 6x6-foot spacing in 6x6-tree plots. Each source is represented in each replication once and there are three replications on this trial site. Thus, 36 x 3 or 108 trees of each seed source were planted here. The entire trial is replicated in northwestern Wisconsin near Gordon and portions of the trial are combined with other lots in a trial in central Wisconsin south of Wisconsin Rapids. After only 5 years in the field a number of striking differences between seed lots can be observed.

1/ Assistant Professor, Department of Genetics, University of Wisconsin, Madison 6, Wisconsin.

Table 1.--Origins of Scotch pine used in University of Wisconsin trials at Starks, Wis.

Lot number	Seed source
SY-2	Filphus, S. Finnskoga, Sweden; plus stand
SY-4	Fredrika, Västerbotten, Sweden; 64° 15' North Lat.; standard population seed
SY-5	Torsås, Ådalsliden, Ång., Sweden
SY-12	Malilla, Kalmar län, stand collection after open pollination, Sweden
SY-13	Kujdalen, Värmland, Sweden
SY-14	Malselv (N. Norway, inland) (above Arctic Circle)
SY-22	Boden, Lappland, Sweden (near Arctic Circle)
SY-31	Vreten, Västergotland, Sweden
SY-32	Runnsjön, Värmland, Sweden
SY-33	Sjöryd, Västergotland, Sweden
SY-34	Thuna, Gotland, Sweden
SY-35	Horeda, Småland, Sweden
SY-38	Sjöarp, Blekinge, Sweden
SY-39	Everlöf, Skåne, Sweden
SY-40	Sundmo, Ångermanland, Sweden
SY-46	Gräfe, Bleuburgsches Revier Tambach, Germany
SY-47	AF, Lüneburg Pr. D. Suderburg, Germany
SY-48	AF : Dm (Vl/3-6) Germany
SY-49	AF : Ndb. Opf. (V/4-7) Stadtforst Tirschenreuth, Germany
SY-50	AF : Lnoaben 100 (Vl/Bay. 3-6) F. A. Unterhauser, Germany
SY-51	Wiesbaden 3, Germany
SY-52	Norbaden 66, Germany
SY-53	Wiesbaden 10, Germany
SY-54	Forstamt Falkenberg, Germany
SY-58	Teruel, Spain
SY-59	Granada, Cirro Trebenque, Spain
SY-60	Burgos, Spain
CSY-1	Plantation in Spruce Woods Reserve, Manitoba, Canada

Field Grafting of Pine

Another phase of tree improvement research is that concerned with vegetative propagation. Field grafting is one means of vegetative propagation which has proved to be very satisfactory and relatively inexpensive when compared to greenhouse grafting. The field grafts here on the University Potato Research Farm were made during the spring of 1956. Although they have been managed for other purposes, one can still assess their growth and development reasonable well.

Unusual Forms of Red Pine

Occasionally there occur in forest trees (as in other kinds of plants) unusual or aberrant growth types. These are called mutations. Differing from the normal or wild type, they often provide the plant breeder with material suitable for more detailed genetic studies. A number of mutant types have been found for red pine, one of which is seen here as a compact, bushy growth type. Other mutant types that have been found include a "snake type" and a number of acutely branch-angled or fastigiate individuals. Several suspected color phase mutations are also under observation.

"Super Spruce" Plantation of the Consolidated Water Power and Paper Company

Tour Guide: John Macon[1/]

These plantations contain trees which were chosen in the Consolidated Water Power and Paper Company nursery for their exceptionally good height growth. With the thought that this expression of energy would also be apparent in field plantings, about 3200 of these tall trees have been planted in this area.

The first planting was made in 1950, when about 1600 super spruce were set out. In one plantation 960 of these trees were interplanted in rows with control trees which represented the average run of stock from the Consolidated nursery for that year. These trees have been examined every year for 12 growing seasons.

Analysis of measurements made on super and control trees reveals that a high proportion of the white spruce transplants that exhibit exceptionally good height growth in the nursery can be expected to produce superior height growth in the field for at least 12 years after planting. Forty percent of the super trees, and only ten percent of the regular trees are currently showing very good height growth. At the end of 10 years,

---

1/ Research Forester, Consolidated Water Power and Paper Company, Rhinelander, Wis.

11 percent of the super trees had a net height increase of at least twice the amount expected for regular nursery stock. None of the control stock met this standard (table 1).

Table 1.--Mean height of super spruce and regular spruce in 1950 plantation

Number of growing seasons after planting	Mean height		Difference
	Super spruce	Regular spruce	
	Feet	Feet	Feet
0	1.1	0.5	0.6
2	1.4	0.8	0.6
4	2.3	1.5	0.8
6	3.6	2.4	1.2
8	4.9	3.4	1.5
10	6.5	4.5	2.0
12	8.7	6.2	2.5

In 1956 another set of super spruce was planted to check the growth history of the 1950 planting and to give us information on other characteristics which may be inherited. The best 700 white spruce trees (out of about 440,000) were chosen and were interplanted with control trees. None of these 2-2 "super" trees were shorter than 17 inches at the time they were lifted from the nursery, whereas mean height for the regular stock was 7.6 inches. Heavy clipping by snowshoe hares has kept the growth rate of these trees slightly below that of the 1950 trees, but the growth pattern is very close to that shown in the 1950 planting.

Hardwood Marking Demonstration on the Argonne Experimental Forest

Tour Guides: R. D. Jacobs, R. B. Hill, Stanley Hurd, and R. K. Train[1/]

In a second-growth northern hardwood stand on the Argonne Experimental Forest a half-acre plot was laid out and all trees on it were numbered and measured. The principal species were sugar maple, basswood, and yellow birch. Stand basal area was 134 square feet and gross volume some 10 M board feet per acre (table 1).

Prior to the conference the half-acre plot was marked for cutting by a geneticist, a research forester, an industrial forester, and a National Forest officer. Marking was done by placing a colored tag (a different color for each marker) on each tree to be cut. The tags were removed immediately after marking so that none of the markers knew what his colleagues had done.

The objectives of the different markers were as follows:

1. Geneticist -- Remove all trees with undesirable characteristics that probably are heritable (such as poor form, thick limbs, broad crowns, poor branch angle, susceptibility to injury).

2. Industrial Forester -- The objective in marking this plot was two-fold: (1) To develop group selection management, and (2) to remove the inferior quality trees in a commercial type operation.

   Basal area was not used as a marking guide. Instead, all trees were classed in one of the following groups, and those of class 3 were removed: (1) Trees adapted to the site and which will produce two clear logs of high-value products at the end of the rotation, (2) trees of intermediate quality and whose retention in the stand is dependent upon quality, stocking needs, species composition, and suitability to soil type, and (3) trees of inferior quality which would add only increased quantity of low-value products throughout the rotation age of the stand.

3. The Research Forester and the Timber Management Assistant each used his own judgment in applying the recommendations given in Lake States Forest Experiment Station Paper 56, "Marking Guides for Northern Hardwoods." Essentially this provides for reducing

---

1/ Respectively, Research Forester, Lake States Forest Experiment Station, Three Lakes, Wis.; Research Forester, Lake States Forest Experiment Station, Rhinelander, Wis.; Forester, Consolidated Water Power and Paper Co., Rhinelander, Wis.; and Timber Management Assistant, Nicolet National Forest, Rhinelander, Wis.

Table 1.--Summary table: Hardwood marking demonstration plot, Argonne Experimental Forest

Size class (inches)	Sugar maple	Bass-wood	Yellow birch	Other hardwoods	Total
			NUMBER OF TREES PER ACRE		
5- 9	54	6	6	8	74
10-14	34	36	2	2	74
15-19	8	18	2	2	30
20+	2	--	2	--	4
Total	98	60	12	12	182
			BASAL AREA PER ACRE		
5- 9	16.80	2.46	1.68	1.80	22.74
10-14	23.34	30.62	1.56	1.32	56.84
15-19	13.48	24.60	3.16	2.46	43.70
20+	5.76	--	5.28	--	11.04
Total	59.38	57.68	11.68	5.58	134.32
			GROSS VOLUME,[1/] BD. FT. PER ACRE		
--	3,664	5,448	832	302	[2/]10,246
			TOTAL VOLUME,[3/] CORDS PER ACRE		
--	19.82	20.40	4.40	1.74	46.36

1/ Gross volume, Scribner Rule, above a 1-foot stump to an 8-inch inside bark top diameter or where merchantability is limited by branches, defect, or deformity. Table No. 1, U.S.D.A. Tech. Bul. 1104, Composite Volume Tables for Timber and Their Application in the Lake States, 1954.

2/ Estimated cull (sample of 18 trees), 24.3 percent.

3/ Volume of stems and branches to a 4-inch top in rough cords, including sawlog trees. Local volume table no. 2, Argonne Experimental Forest.

the stocking to about 70 square feet of basal area in trees of sawtimber size (10 inches and up in d.b.h.) by removing the trees of poorest quality and potential.

At the time of the field stop the colored markers were placed on the designated trees and the foresters who had done the marking were on hand to explain why they had marked as they did. Since timber marking is an art rather than a science, and thereby subject to considerable individual interpretation, there were differences in the marking, particularly on an individual-tree basis. Despite these differences there seemed to be surprisingly good agreement between the three jobs in the basal area of the residual stand (table 2). From a technical standpoint, what was shown here was that, regardless of objectives or personal experience, northern hardwood management in the Lake States is fairly uniform.

Table 2.--Marking summary of hardwood demonstration plot, Argonne Experimental Forest

Marked by --	Basal area	Volume of sawlog trees: Gross	Volume of sawlog trees: Net	Total volume
	Sq. ft.	Bd. ft.	Bd. ft.	Cords
		MARKED PER ACRE		
Industrial forester	68.0	5586	4150	24.1
National Forest officer	66.1	5974	4170	24.3
Research forester	63.8	4956	3336	22.8
Geneticist	60.4	4870	3370	21.8
		RESIDUAL PER ACRE		
Industrial forester	66.3	4660	3638	22.3
National Forest officer	68.2	4272	3867	22.1
Research forester	70.5	5290	4557	23.6
Geneticist	73.9	5376	4642	24.6

Questions from visitors to the demonstration provided interesting discussion on the ground. Much of the discussion was conducted in small groups, with or without the markers. The fact that group selection was advocated as a system of management by the industrial forester rather than the usual individual tree selection brought out considerable discussion and mild disagreement. However the reasons given by the marker for suggesting the use of group selection were: (1) To secure, if possible, better species composition and avoid a maple monotype which is prevalent throughout much of the area and (2) to avoid the heavy deer browsing that has influenced and retarded the development of good hardwood regeneration in this immediate area. The assumption was that openings would help to "force" the growth of newly established hardwood regeneration, following 4 liberal deer seasons in this area.

Regional Jack Pine Seed Source Study

Tour Guides: Thomas D. Rudolph, Paul O. Rudolf, and Hans Nienstaedt[1/]

In 1951 the Lake States Forest Experiment Station and the University of Minnesota jointly drew up plans for a regional jack pine seed source study to complement two such studies already underway, one in Minnesota and one in Michigan. The primary objective was to study racial differences in jack pine within the Lake States.

Cooperating federal, state, and private forestry agencies collected cones from 29 jack pine stands in the three Lake States during 1951 and 1952 (table 1). Each collection was made from dominant and codominant trees in a stand considered good for its locality. Seedlings were grown for 2 years in the General Andrews State Nursery at Willow River, Minn., and in the Hugo Sauer State Nursery at Rhinelander, Wis.

The 2-0 stock was set out in 17 plantations in the Lake States (table 2), one of which is the plantation on the Argonne Experimental Forest. This plantation was established in May 1954 and contains all of the 29 sources, plus a source designated as "local" and selected from stock grown at the Toumey Nursery, Watersmeet, Mich., for general distribution. A 2-row isolation strip of this "local" stock surrounds the plantation.

A randomized block design with four replications was used in all the plantations. Each seed origin was represented in each block by a 64-tree plot arranged in 8 rows of 8 trees. The trees were planted 5 feet apart with 5 feet between rows.

Survival counts made at the end of the first growing period in the field showed considerable variation between seed sources, but no definite patterns of differences were apparent. First-year losses were replaced in the spring of 1955, and stocking averaged about 98 percent at the end of the second year in the field. Small differences in height between seed sources were found in the second-year measurements, but no trends were evident.

The average heights obtained at the end of the fifth year in the Argonne plantation showed a wider range between seed sources than was found in earlier measurements. The greatest average height, 6.03 feet, was

---

1/ Staff members of the Lake States Forest Experiment Station. Respectively Research Forester, Rhinelander, Wis.; Research Forester, St. Paul, Minn.; and Geneticist, Rhinelander, Wis.

Table 1.--Information on seed collections used in regional jack pine seed source study

Collection number	Date collected	Collection area			Stand	
		Unit[1]	County	Legal description	Average age	Site quality[2]
			MINNESOTA			
1589	3-29-51	Chippewa N. F.	Cass	SE SW, Sec. 8, T. 145 N., R. 29 W.	46	II
1590	4-12-51	Chippewa N. F.	Cass	W½ SW, Sec. 17, T. 141 N., R. 31 W.	50	I
1591	3-15-51	Cutfoot E. F.	Itasca	S½ NW, Sec. 26, T. 147 N., R. 27 W.	76	II
1592	4-10-51	Superior N. F.	Lake	Sec. 32, T. 61 N., R. 7 W.	85	III
1593	4- 4-51	Superior N. F.	Cook	NE NE, Sec. 14, T. 63 N., R. 1 E.	65	IV
1594	3-27-51	Superior N. F.	St. Louis	E½ SE, Sec. 26, T. 65 N., R. 16 W.	75	III
1595	9- 3-51	St. Croix S. P.	Pine	SE SE, Sec. 36, T. 41 N., R. 18 W.	55	V
1596	1- ?-52	Gen. Andrews E. F.	Pine	SW SW, Sec. 25, T. 45 N., R. 20 W.	33	IV
1597	4- 5-51	White Earth S. F.	Becker	SE NE, Sec. 4, T. 142 N., R. 37 W.	50	I
1600	4- 5-51	Crow Wing S. F.	Cass	N½ NW, Sec. 28, T. 138 N., R. 29 W.	52	II
1601	4- 3-51	Miss. Hdwtrs. S. F.	Beltrami	NE SE, Sec. 16, T. 147 N., R. 34 W.	38	V
1602	4-11-51	Geo. Wash. S. F.	Itasca	NW SW, Sec. 2, T. 61 N., R. 23 W.	52	II
			WISCONSIN			
1604	4-23-51	Mosinee I. F.	Douglas	SW¼, Sec. 20, T. 45 N., R. 11 W.	39	III
1605	3-29-51	Chequamegon N. F.	Bayfield	NW NW, Sec. 18, T. 49 N., R. 5 W.	50	II
1606	6- 4-51	Nicolet N. F.	Forest	NE¼, Sec. 11, T. 41 N., R. 13 E.	38	II
1607	6- 5-51	Nicolet N. F.	Oneida	SE NW, Sec. 24, T. 39 N., R. 11 E.	32	III
1608	3-22-51	Burnett C. F.	Burnett	NE SE, Sec. 18, T. 39 N., R. 14 W.	50	III
1609	3-23-51	Marinette C. F.	Marinette	NE SW, Sec. 21, T. 32 N., R. 18 W.	50	III
1610	4-10-51	Nepco I. F.	Oneida	NE SE, Sec. 13, T. 38 N., R. 5 E.	39	I
1611	11- 7-51	Nepco Lake area	Wood	SW NE, Sec. 6, T. 21 N., R. 6 E.	60	IV
			MICHIGAN			
1612	3-22-51	Ottawa N. F.	Gogebic	SW SW, Sec. 26, T. 44 N., R. 39 W.	35	II
1613	3-16-51	Ottawa N. F.	Ontonagon	NW NW, Sec. 14, T. 48 N., R. 38 W.	39	II
1614	4- 6-51	Hiawatha N. F.	Alger	NW SW, Sec. 22, T. 45 N., R. 19 W.	70	IV
1615	3-30-51	Marquette N. F.	Chippewa	NW SE, Sec. 7, T. 45 N., R. 4 W.	62	V
1616	1- 2-52	Manistee N. F.	Manistee	SW NE, Sec. 12, T. 21 N., R. 16 W.	52	V
1617	5-22-51	Ogemaw S. F.	Ogemaw	NE SE, Sec. 7, T. 21 N., R. 3 E.	48	IV
1618	5-24-51	Alpena S. F.	Alpena	NW SW, Sec. 12, T. 30 N., R. 7 E.	35	III
1620	6-11-51	Fife Lake S. F.	Grand Trav.	SE SW, Sec. 34, T. 25 N., R. 9 W.	60	V
1621	5-12-51	Lake Superior S. F.	Luce	SW SW, Sec. 21, T. 49 N., R. 9 W.	65	V

1/ N. F. = National Forest; S. F. = State Forest; C. F. = County Forest; E. F. = Experimental Forest; I. F. = Industrial Forest; S. P. = State Park.

2/ Adjective descriptions of site qualities are as follows: I = Excellent; II = Good; III = Medium; IV = Poor; V = Very Poor.

Table 2.--Information on plantations established in the regional jack pine seed source study

Plantation number	Date planted (1954)	Ground preparation	Agency by which established	Location: Forest	Location: County	Location: Legal description	Average first year survival
							Percent
1	5/26-27	Disked	U. S. Forest Service	Superior N. F.[1]	Lake	E$\frac{1}{2}$ NW$\frac{1}{4}$, S. 29, T. 60 N., R. 6 W.	95
2	5/18-19	"	"	Chippewa N. F.	Beltrami	SW$\frac{1}{4}$ NW$\frac{1}{4}$, S. 35, T. 146 N., R. 30 W.	70
3	5/18-19	Furrowed	Minnesota Cons. Dept.	Pillsbury S. F.	Cass	NW$\frac{1}{4}$ SE$\frac{1}{4}$, S. 3, T. 134 N., R. 30 W.	91
4	5/ 3- 4	"	"	Sand Dunes S. F.	Sherburne	SW$\frac{1}{4}$ NE$\frac{1}{4}$, S. 21, T. 34 N., R. 27 W.	86
5	9/9-10/53	"	"	Gen. Andrews E. F.	Pine	NW$\frac{1}{4}$ NE$\frac{1}{4}$, S. 24, T. 45 N., R. 20 W.	68
6	5/18	Disked	University of Minnesota	Cloquet E. F.	Carlton	E$\frac{1}{2}$ NE$\frac{1}{4}$, S. 29, T. 45 N., R. 17 W.	94
7	5/10	Furrowed	Burnett County	Burnett C. F.	Burnett	W$\frac{1}{2}$ SE$\frac{1}{4}$, S. 31, T. 37 N., R. 19 W.	93
8	5/ 1	"	Mosinee Pulp & Paper Mills Co.	Mosinee I. F.	Washburn	SE$\frac{1}{4}$ SE$\frac{1}{4}$, S. 10, T. 42 N., R. 13 W.	98
9	5/18-20	"	U. S. Forest Service	Chequamegon N. F.	Bayfield	S$\frac{1}{2}$N$\frac{1}{2}$ NW$\frac{1}{4}$, S. 16, T. 45 N., R. 8 W.	89
10	5/ 6- 7	"	Nekoosa-Edwards Paper Co.	Nepco I. F.	Wood	SW$\frac{1}{4}$ SE$\frac{1}{4}$, S. 31, T. 21 N., R. 6 E.	90
11	5/ 5- 6	"	U. S. Forest Service	Argonne E. F.	Forest	NE$\frac{1}{4}$ NE$\frac{1}{4}$, S. 21, T. 38 N., R. 12 E.	97
12	4/29-5/5	"	Marinette County	Marinette C. F.	Marinette	NE$\frac{1}{4}$ SW$\frac{1}{4}$, S. 14, T. 37 N., R. 20 E.	95
13	5/18-20	Disked	U. S. Forest Service	Ottawa N. F.	Ontonagon	SW$\frac{1}{4}$ SW$\frac{1}{4}$, S. 27, T. 46 N., R. 39 W.	85
14	5/ 6,10 and 11	Furrowed	Michigan Cons. Dept.	Lake Superior S.F.	Luce	SW$\frac{1}{4}$ SW$\frac{1}{4}$, S. 8, T. 49 N., R. 10 W.	85
15	5/ 3- 5	"	University of Michigan	Biological Station	Emmet	NE$\frac{1}{4}$ NW$\frac{1}{4}$, S. 1, T. 36 N., R. 4 W.	95
16	5/ 3- 5	"	Michigan Cons. Dept.	Au Sable S. F.	Crawford	NW$\frac{1}{4}$ NW$\frac{1}{4}$, S. 31, T. 25 N., R. 3 W.	96
17	4/29-30	"	"	Fife Lake S. F.	Grand Trav.	NE$\frac{1}{4}$ NE$\frac{1}{4}$, S. 29, T. 25 N., R. 9 W.	96
							90

1/ N. F. = National Forest; S. F. = State Forest; C. F. = County Forest; E. F. = Experimental Forest; I. F. = Industrial Forest.

attained by source 1618 from Alpena County, Michigan, and the poorest height growth was found in sources 1591 and 1593 from northeastern Minnesota, and in the "local" source, originating on the Ottawa National Forest (and 1 year younger from seed than the other sources). These three sources were approximately a foot shorter on the average than source 1618 (table 3). Survival showed wide differences between sources in the fifth year. The lowest stocking was found in source 1611, the southernmost collection in Wisconsin with 77.7 percent, and the best in source 1600 with 96.9 percent (table 3).

In addition to measurements of height and survival, other measurements and observations have been made in this and the other plantations. Differences between seed sources have been noted in susceptibility to the white-pine weevil and other injurious agents, and in winter foliage color.

A recently completed study revealed highly significant differences in the occurrence of lammas growth[2/] and prolepsis[3/] between seed sources in six of the seed source plantations studied in 3 successive years, indicating that the tendency to form these late shoots is inherited.

The occurrence frequency of late shoots varies significantly between plantations and from year to year, suggesting that, although the late-shoot formation is under genetic influence, it has a wide range of reaction to environmental conditions. Regression analyses showed that the frequency of all late-shoot types, with the exception of prolepsis, increases predictably (1) with more southerly latitude of seed origin, (2) with an increase in degree days over 50° F. of the origin, and (3) with higher average July temperatures of the origin. Proleptic shoot occurrence showed no relationship to latitude but was related to temperature conditions prevailing in the seed source locality.

The variation in late-shoot occurrences between sources showed a clinal pattern, indicating that formation of lammas and proleptic shoots is controlled by more than a single pair of genes.

Trees with lammas growth did not grow significantly less the following season than those with normal growth the previous season.

Tree form was found to be influenced by lammas growth and prolepsis, the seriousness of the deformation depending upon the type of late-shoot development and on the size of such shoots. In total, the results of the study of lammas growth and prolepsis pointed to the conclusion that seed collection from trees with late shoots or in stands with a high frequency of these growth types should be avoided.

2/ Elongation of the terminal bud after normal seasonal height growth is completed.

3/ Elongation of lateral buds after normal seasonal height growth is completed.

Table 3.--Summary of survival and height development at the end of 5 years in the field, jack pine in the seed source plantation on the Argonne Experimental Forest, northeastern Wisconsin

Seed source	Survival	Average height
	Percent	Feet
	MINNESOTA	
1589	93.8	5.93
1590	91.8	5.62
1591	91.4	5.16
1592	95.7	5.53
1593	96.1	5.06
1594	94.9	5.28
1595	89.1	5.84
1596	95.3	5.80
1597	95.7	5.94
1600	96.9	5.68
1601	93.4	5.80
1602	96.5	5.86
	WISCONSIN	
1604	87.5	5.70
1605	91.8	5.32
1606	92.6	5.53
1607	92.2	5.64
1608	91.0	5.67
1609	87.9	5.85
1610	91.8	5.94
1611	77.7	5.22
	MICHIGAN	
1612	95.3	5.86
1613	91.0	5.47
1614	95.7	5.41
1615	94.9	5.44
1616	80.5	5.93
1617	82.0	5.82
1618	89.1	6.03
1620	88.7	5.82
1621	96.5	5.40
LOCAL	91.4	5.08

Early results of the jack pine seed source study have been presented in the following publications:

Arend, John L.; Smith, Norman F.; Spurr, Stephen H.; and Wright, Jonathan W.
1961. Jack pine geographic variation--five-year results from Lower Michigan. Mich. Acad. Science, Arts, and Letters Papers 46: 219-238.

Batzer, H. O.
1961. Jack pine from Lake States seed sources differ in susceptibility to attack by white-pine weevil. U. S. Forest Serv., Lake States Forest Expt. Sta. Tech. Note 595, 2 pp. (Processed.)

Jensen, Raymond A.; Schantz-Hansen, T.; and Rudolf, Paul O.
1960. A study of jack pine seed source in the Lake States. Minn. Forestry Notes No. 88, 2 pp. (Processed.)

Stoeckeler, J. H., and Rudolf, Paul O.
1956. Winter coloration and growth of jack pine in the nursery as affected by seed source. Ztschr. Forstgen. Forstpflanzenzüchtung 5: 161-165.

Spruce Seed Source and Species Trial

Lake States Forest Experiment Station

Tour Guides: Hans Nienstaedt, Paul O. Rudolf, and Thomas D. Rudolph[1/]

This area on the Eagle River district of the Nicolet National Forest was planted with 2-2 spruce stock of several species and origins (table 1) in 1936 under a partial overstory of aspen and birch. Other plantations were established in Minnesota and Michigan the same year without a protective overstory, but they were lost as a result of the severe drought of 1936. The overstory on the Wisconsin plantation was removed gradually by cutting and girdling; removal was completed when the stand was about 20 years old.

Although the number of seed sources is too small to permit developing any pattern of racial variation within the species involved, the studies do point toward some outstanding seed sources of both white spruce and Norway spruce.

White spruces from Angus and Douglas, Ontario, outgrew white spruce from Florence, Wis. (the nearest local source), in height by 12.8 and 13.6 percent respectively at the age of 15 years, and the trees of these Canadian origins continue to develop well.

1/ Staff members of the Lake States Forest Experiment Station. Respectively Geneticist, Rhinelander, Wis.; and Research Foresters, St. Paul, Minn., and Rhinelander, Wis.

Table 1.--Origin of spruce seed collections

Collection number	Place of origin	Collection date	Kind of collection[1/]
	WHITE SPRUCE (*Picea glauca* (Moench) Voss)		
32-33	19 miles W. of Port Arthur, Ontario	9- 2-28	2
39	Victor Hill Road, Superior N. F., Minn.	9-15-28	1
255	Chippewa N. F., Minn.	1928	4
256	Near Angus, Ontario	1929	4?
257	Near Douglas, Ontario	1929	4?
270	Black Hills; through dealer at Custer, S.D.	1931	3
273	Near Florence, Wis.	9-30	4?
	NORWAY SPRUCE (*Picea abies* (L.) Karst.)		
131	Northern Europe - purchased from dealer	1929?	4?
134	Mozyr District, White Russia, USSR	1929?	3
135	Bryansk Forest Expt. Sta., USSR	1929?	3
137	Gomel District, White Russia, USSR	1929?	3
138	Forest Res. Sta. U. of Belgrade, Yugoslavia	1929	3?
140	Between Mauston & Wis. Dells (formerly Kilbourn) Wis.	9-14-30	1
	SIBERIAN SPRUCE (*Picea obovata* Ledeb.)		
132	Siberia - purchased from dealer[2/]	1929	4?
	RED SPRUCE (*Picea rubens* Sarg.)		
271	Pisgah N. F., N. C., and Unaka Ranger District, Tenn.	1931	4
272	Monongahela N. F., W. Va.	1931	4
	BLACK SPRUCE (*Picea mariana* (Mill.) B.S.P.)		
N	Chippewa N. F., Minn.	1930	3
	SAKHALIN SPRUCE (*Picea glehni* (Fr. Schmidt.) Mast)		
90	Jozanekei, near Sapporo, Japan	1928?	4
	ORIENTAL SPRUCE (*Picea orientalis* (L.) Link.)		
133	Groosya (Georgia), Cobovletse Nursery, Caucasus, USSR	1929	3
	SERBIAN SPRUCE (*Picea omorika* (Pancic) Purkyne)		
139	Forest Res. Sta. U. of Belgrade, Yugoslavia	1929	3?

1/ 1 = individual tree; 2 = small group; 3 = limited locality; 4 = general and mixed.

2/ The identity of this collection is very questionable. It appears to be a collection of *Picea abies* of unknown origin.

Norway spruce from the Mozyr, Bryansk, and Gomel Districts in the U.S.S.R. similarly outgrew Norway spruce collected in Wisconsin from trees assumed to be of German origin by 12.4, 13.9, and 11.7 percent respectively. Norway spruce from Yugoslavia grew slowly and is highly susceptible to *Chermes abietis*; two severe outbreaks have occurred during the past 6 years. All other seed sources showed little or no damage from this insect.

Serbian spruce (*Picea omorika*) has shown very low survival, but some of the surviving individuals have developed well. They have recently begun to flower and have been used in a program of reconnaissance crossing within the genus *Picea*. The fact that the few surviving individuals--of the original 900 planted--are developing so well points to the importance of bulk plantings of exotics to be tested. By planting large unreplicated field tests, it may be possible to select a few individuals adapted to the test climate; in small formal replicated tests, they may not be found.

The red spruce (*P. rubens*) used in the tests originated in the southern portion of the range of the species, in West Virginia and North Carolina--Tennessee. Although survival and growth usually have been poor, a few individuals have developed relatively well. Some have produced a considerable number of flowers and have been used in the reconnaissance crossing within the genus.

Sakhalin spruce (*P. glehni*) from Sapporo, Japan, and Oriental spruce (*P. orientalis*) from Georgia, U.S.S.R. were almost complete failures. The few surviving individuals are very small.

Future work in the study area will emphasize controlled crossing between seed sources in white spruce and Norway spruce. A number of trees have been selected and marked for this work. These collections were based on quality and vigor and on unusual characteristics of branching, needles, and stem.

Red Pine Seed Production Area, Rosen Dam, Eagle River District, Nicolet National Forest

Tour Guide: J. Terry Moore[1/]

The Rosen Dam "seed production area" is one of three such areas on the Nicolet National Forest in northeastern Wisconsin. Two of these areas are being managed for the production of red pine seed and one for white spruce seed.

1/ Assistant Ranger, Eagle River District, Nicolet National Forest, Eagle River, Wis.

A "seed production area" is defined as "a superior (plus) stand which is upgraded by periodic removal of undesirable trees (roguing) and cultivated for early and abundant seed production." It is our Regional goal to establish sufficient "seed production areas" to supply the number of seedlings required for each Forest's annual planting program. Such areas are being selected from the best natural stands available on each National Forest and managed solely for seed production. The seed production areas fill an intermediate step and an immediate need in the production of superior quality seed. The ultimate goal is to establish seed orchards of trees whose genetic qualities have been proven.

The initially established orchards will be intensely managed plantations of selected individual trees. The genetic quality of each parent tree within a seed orchard will be examined through tests of its progeny. The results derived from these tests will determine which individuals are actually of sufficient quality to be retained in the orchard, and to what extent the seed from this orchard may be distributed. Initially, the distribution of seed from any particular orchard will have to be limited to a small geographic area, probably to one Forest. After progeny tests indicate the best range, these areas can be adjusted.

The initial step in the establishment of Region Nine's first seed orchard will begin this fall on the Ottawa National Forest near Marenisco, Mich. This area will eventually supply high-quality spruce seedlings for portions of the Ottawa and Nicolet National Forests. National Forest personnel are constantly on the lookout for trees of phenotypic superiority, and, as a sufficient number of these individuals are selected, additional seed orchards will be established.

Stand History

The Forest Service purchased this area from the Thunder Lake Logging Company in 1934. The stand was established naturally after a seed-tree cut sometime during the 1920's. Cultural work was first done in this stand in 1936, when a liberation cut was made and many of the trees were pruned. In 1954, a K-V project was carried out in the portion of the stand south of Highway 70. At that time the stand was thinned from below and additional trees were pruned. The present cut is believed to be the first commercial cutting.

Stand Before Cutting

Total area of type---	35 acres	Site index-----------	48 feet
Age------------------	40 years	D.b.h. range----------	5-8 inches
Height---------------	38 feet	Average basal area---	106 Sq. ft. (95 sq. ft. red pine, 11 sq. ft. misc.)

Selection of Seed Trees

The marking of this area was done by the Eagle River District Ranger, Assistant Ranger, and the Forester, after training by Hans Nienstaedt and Paul Rudolf of the Lake States Forest Experiment Station. On the 8 acres that have been cut, 347 trees of seed tree quality were selected. Some of these will be in the isolation zone. The portion of the stand that will be used for seed production has about 85 trees per acre remaining.

The total marking job for this portion of the stand took 7½ man-days, including 3 man-days for initial training. Cost of marking this area, excluding training, was $14.94 per acre.

Volume Removed

The estimated cut from this area is 40 cords of pulpwood and 4 MBM of sawlogs. Total value of the material removed was $130.

Cultural Work

The slash from the logging operation was removed from the seed production area by mechanical chipping. The cost of this work was $60 per acre. The trees were pruned to the live crown, and one side of the tree pruned to 10-foot sections to allow the climbing ladders to get up to the tree. Part of the pruning was done by summer camp students from the Purdue University Forestry Camp at Lost Lake. The estimated value of this work is $21 per acre.

The area will be treated with herbicide to reduce future brush and other competition.

COMMON AND SCIENTIFIC NAMES OF TREE GENERA AND SPECIES MENTIONED IN THE TEXT[1/]

Common Name	Scientific Name
Ash	*Fraxinus*
Aspen, bigtooth	*Populus grandidentata*
Aspen, Davids European	*P. tremula* var. *davidiana*
Aspen, European	*P. tremula*
Aspen, quaking	*P. tremuloides*
Aspen, Siebold's	*P. sieboldi*

1/ Authorities for nomenclature are: Check List of Native and Naturalized Trees of the United States, by Elbert Little, U.S.D.A. Agr. Handb. 41, 1953; and Standardized Plant Names, by Harlan P. Kelsey and William A. Dayton, 1942, Harrisburg, Pa.

Common Name	Scientific Name
Basswood, American	*Tilia americana*
Birch, yellow	*Betula alleghaniensis*
Cottonwood	*Populus*
Douglas-fir	*Pseudotsuga menziesii*
Eucalyptus	*Eucalyptus*
Fir	*Abies*
Hemlock	*Tsuga*
Junipers	*Juniperus*
Larch, Dunkeld	*Larix eurolepis*
Larch, European	*L. decidua*
Larch, Kurile Dahurian	*L. gmelini* var. *japonica*
Larch, Polish	*L. decidua* var. *polonica*
Maple	*Acer*
Maple, sugar	*A. saccharum*
Oak	*Quercus*
Pine, Austrian	*Pinus nigra*
Pine, Corsican	*P. nigra poiretiana*
Pine, jack	*P. banksiana*
Pine, red	*P. resinosa*
Pine, Scotch	*P. sylvestris*
Poplar	*Populus*
Poplar, white	*P. alba*
Spruce, black	*Picea mariana*
Spruce, Norway	*P. abies*
Spruce, oriental	*P. orientalis*
Spruce, red	*P. rubens*
Spruce, Sakhalin	*P. glehni*
Spruce, Serbian	*P. omorika*
Spruce, white	*P. glauca*

LIST OF PUBLICATIONS PREVIOUSLY ISSUED FOR

THE LAKE STATES FOREST TREE IMPROVEMENT COMMITTEE

Proceedings, Lake States Forest Genetics Conference, March 31 - April 1, 1953. Lake States Forest Expt. Sta. Misc. Rpt. 22, 83 pp. (Processed.) 1953.

Proceedings, Lake States Forest Tree Improvement Conference, August 30-31, 1955. Lake States Forest Expt. Sta. Misc. Rpt. 40, 108 pp., illus. (Processed.) 1955.

Forest Genetics in the Lake States, an Annotated Bibliography, by William J. Libby, Burton V. Barnes, and Stephen H. Spurr. Univ. Mich. School of Natural Resources (no series), 74 pp. (Processed.) 1956.

Guide for Selecting Superior Trees and Stands in the Lake States, by Paul O. Rudolf. Lake States Forest Expt. Sta., Sta. Paper 40, 32 pp., illus. (Processed.) 1956.

Forest Tree Seed Collection Zones for the Lake States. Mich. Dept. Conserv., Forestry Div. (no series), 13 pp., illus. (Processed.) 1957.

Proceedings, Third Lake States Forest Tree Improvement Conference, Sept. 17-18, 1957. Lake States Forest Expt. Sta., Sta. Paper 58, 87 pp., illus. (Processed.) 1958.

Forest Tree Improvement Research in the Lake States; A Survey by the Lake States Forest Tree Improvement Committee. Lake States Forest Expt. Sta., Sta. Paper 74, 56 pp. (Processed.) 1959.

Registering and Marking Selections in the Lake States; A Report of a Subcommittee of the Lake States Forest Tree Improvement Committee, by Paul O. Rudolf and H. E. Ochsner. U. S. Forest Serv., North Central Region (no series), 9 pp. (Processed.) 1959.

Forest Tree Seed Certification in the United States; A Report of a Subcommittee of the Lake States Forest Tree Improvement Committee, by J. W. Macon. Consolidated Water Power & Paper Co. (no series), 3 pp. (Processed.) 1959.

Proceedings of the Fourth Lake States Forest Tree Improvement Conference, October 6 and 7, 1959. Lake States Forest Expt. Sta., Sta. Paper 81, 60 pp., illus. 1960.

Growth Through Agricultural Progress