FOREST TREE SEED VERIFICATION AND CERTIFICATION [1/]

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We all accept tested and recommended brands. On electrical equipment the UL stamp of approval is a "must." Toys for the kids must be name brands or else be tested by the staff of Parents' Magazine. Consumer Reports aid many in buying appliances, etc. When we travel, most of us seek restaurants recommended by either Duncan Hines or the AAA. And so it goes.

But what do we do in forestry--and I refer here to our dealings today in tomorrow's future--that is, in our reforestation efforts? All too often in reforestation the concern to get enough trees for planting overshadows the desirability of getting stock of high genetic quality with the result that today's investments are destined to pay a low return in tomorrow's markets. We are all stewards of the land, and it is our responsibility, regardless of the field of endeavor we pursue, to make the land a better place for our having been here.

Let us then consider this responsibility as it applies to but one area of forestry, namely, reforestation.

There is a Biblical saying, "By their fruits ye shall know them." Truer words could not be spoken when we consider the real meaning of the phrase. A forest tree seed--only a seed--and yet it may become the tenant on a portion of forest land for perhaps a century or more. Should it not, therefore, be of the best possible type? Should we not know something of its ancestry, its place of origin, its growth potential as reflected by parental performance? Certified seed, according to Baldwin, is "seed that is guaranteed to conform to certain requirements as to origin, purity, germintion, etc., often based wholly or in part on results of official inspection or test." Should we not then consider "certification" for our tree tenants? The idea of certification for forest tree seed is not new. It has been practiced for decades in European countries, and I would suspect in the Asiatic countries as well. Perhaps it was not designated certified seed; nevertheless, it functioned as such. Duhamel as early as 1760 published fundamental observations on hereditary behavior in forest trees. During the period from 1820 to 1840, De Vilmorin in France carried out investigations which clearly showed that species of forest trees could be broken up into climatic races and as such deserved special considerations in any program of reforestation which involved acquisition of seed from other than local sources. De Vilmorin's work was, according to Larsen, a "botanical piece of work, in respect of which unfortunately forestry again displayed its independence by leaving it unheeded."

In this country C. G. Bates in 1927 presented a strong case for the establishment of a program of seed certification for forest tree seed. Bates, in one portion of the paper, "ventures the assertion that between 25

1/ Paper No. 811 from the Department of Genetics, University of Wisconsin.

and 50% of all forest planting in the U. S. to date (1927) represent wasted effort--in the form either of immediate plantation losses or of eventual terrific disappointment in the quality of the timber produced--because of the use of poorly adapted species and races of trees. Too often failing plantations are charged to cultural factors, when the fundamental trouble arises from the fact that the strain used is inherently incapable of adapting itself to the conditions....An outstanding and undeniable cause of the poor quality which already is exhibited by many forest plantations and which will appear more obviously as time goes on, is the fact that most forest tree seed is taken from the poorest possible specimens. Good trees may occasionally creep in as the mothers of our future forests--in nature they do. But it is almost inevitable that where there is the economic urge of 'cheap seed' poor, scrubby trees will be the 'mammas.'"

Leopold in 1929 had also advocated the selection and use of the best quality forest tree stock. In a paper in that year in the Journal of Forestry, he stated: "Where there is a probability that a character is genetic, select for it if this can be done without great extra cost. The extra cost is all that can possibly be lost whereas the gains may be large and cumulative in their effects on the character of the stand."

H. I. Baldwin in New Hampshire has been advocating for some time the establishment of seed certification standards for forest tree seed. The Seed Policy Committee of the USDA in 1939 drew up a policy regarding seed used in federal stations. The general points of this policy were:

1. Only seed of known locality and nursery stock of such seed should be used.

2. Seed vendors must verify as to origin of seed.

3. Nursery records on all seedlots should be maintained.

4. Local seed should be used unless other sources are determined to be better.

5. State and other agencies engaged in planting, the expense of which is wholly or partly borne by the U. S. government, should be urged to adhere to this same policy.

On the same day that this policy was adopted by the Chief of the U. S. Forest Service, New York passed a law that all tree and shrub seeds sold in New York must be labeled to show purity, germination, and specific locality of origin.

Among the first U. S. seed dealers to offer origin data and some information on purity and germination percent was the Brown Company of Berlin, New Hampshire. The Manning Seed Company of the Pacific Northwest has in the last few years offered its customers a $10,000 bonded guarantee backed by Lloyd's of London on the certification of their seed. But I'm jumping ahead of myself here. . . .

During the war years the work on tree improvement here and in most European countries was curtailed. Fortunately, the Swedes were able to continue their efforts and as a result are among the leaders in this field.

The Society for Practical Forest Tree Improvement has made great strides in setting out seed orchards throughout north-central Sweden. Recently, the Association for Forest Tree Breeding and the Society for Practical Forest Tree Improvement were merged into the Association of Forest Tree Breeding.

A national program has been undertaken to establish a network of seed orchards for the production of forest tree seed. A total of over 1,800 acres will be established, about two-thirds of which will be state-owned and one-third privately owned. Nearly 750 acres of the total area have already been established. The species of greatest importance in the orchard program are Scotch pine and Norway spruce, with larch, oak, beech, Douglas-fir, and a few other species of pine and spruce to a lesser degree. The orchards are to be classified in the following groups: plus tree orchards, provenance orchards, species crossing orchards, and elite orchards. The first three are to be composed of plus trees that have not yet been progeny-tested. Plus tree orchards and provenance orchards will be made up of plus trees belonging to the same species, while species crossing orchards will be made up of selected trees of different species known to cross-pollinate and known to produce desirable interspecific crosses. Plus tree orchards will contain material from a single provenance, while provenance orchards will be made up of selections from two or more provenances. Elite orchards will contain only trees that have been proved to be genetically superior in clonal and progeny tests.

Largely through the efforts and encouragement of Professor Bertil Lindquist, linger Jensen, the owner of the Ramlosa Plantskola near Hglsingborg, Sweden, has established a series of private forest tree seed orchards. Included in the system are birch, alder, ash, oak, walnut, larch, pine, and spruce.

In Denmark the state government has started the establishment of forest tree seed orchards. These are in addition to the material being assembled in the national arboretum at Horsholm.

Mathews reports the establishment of seed orchards in England for Scotch pine, various larches, Douglas-fir, beech, and Austrian pine.

Germany has also started a number of seed orchards, and in general a great deal of excellent research is in progress in Germany on tree improvement. A large seed testing and seed research laboratory is maintained at Munich. The Europeans in general have for years paid attention to seed source in their reforestation efforts; consequently, formalized certification of forest tree seed will be a step forward for them, but certainly not a new concept.

In the period since the second World War, great strides have been made in the field of tree improvement in the United States. At present tree

improvement research is in progress in every major forest region of the country.

The work that is probably the most productive per unit of time involved is that in progress in the South. There climate, species, and calendar work together to favor rapid progress. Every effort is being made by various organizations throughout the South to establish as quickly as possible networks of seed orchards. In Florida Perry and Chi Wu Wang have, in conjunction with industrial cooperators, established a series of seed orchards. In Georgia the Georgia Forestry Commission has established a program of Sorest tree improvement, including establishment of seed orchards.

The Georgia Forestry Commission, in cooperation with the Georgia Crop Improvement Association, has also established a program for the certification of forest tree seed used by the forest industry in Georgia. They recognize three types of seed sources--seed-producing areas, seed orchards, and elite trees. Three classes of seed have been suggested. Class I seed will come from seed orchards, Class II seed from seed orchards and elite trees, and Class III from seed-producing areas.

The Texas Forest Service, in cooperation with certain forest industries, has established seed orchards. Seed production areas have also been established, and various studies on the cost of seed production have been undertaken.

In a paper in the November 1958 issue of the Journal of Forestry, Perry and Wang discuss the value of genetically superior seed. In considering even the most modest gains we could expect and allowing for an interest rate of 5 percent per annum for 25 years, they propose that seed initially costing $3.50 to $4.00 per pound would more than pay its way. They then discuss collecting seed during poor seed years or securing seed or planting stock from areas of a less desirable source--to be used in lieu of stock from local or proved acceptable sources. They show the financial saving to be obtained by delay of planting rather than by use of inferior stock. They conclude the paper by stating: "Genetic improvement of as little as one or two percent more than justify the extra costs involved in programs of seed orchard establishment or in programs of harvesting seed from seed production areas. Frequently, because of improper geographic origin or inferior genetic quality, the only seedlings available for planting will yield growth rates and profits four percent or more below average. Under such circumstances profits can be increased by delaying planting for a year or two to obtain seed of acceptable genetic quality and proper geographic origin." (These remarks refer particularly to slash and loblolly pine.)

One might now well ask: "Seed orchards all over the place--that's fine--but what about the interim period?" This point is being taken into consideration.

The Westvaco program, started in about 1952, has been a fine example of industrial leadership in the field of practical tree improvement efforts. The company has established a series of seed production areas. Seed trees are marked, and the inferior trees are removed. Open-pollination is allowed to occur, and then In a good seed year, following the improvement

cutting operation, the remaining seed trees are cut in the proper season for cone collection. In 1956-57 over 11 million loblolly and slash pine seedlings from selected mother trees were planted in the field by this company. Their program of careful seed collection, extraction and grading of seed, a modest seed orchard program, and some special breeding for specific characters has swung the pendulum from disgenic forest practices to one of high eugenic practices which will undoubtedly be reflected in the genetic quality of future stands on their lands.

In most of the programs mentioned, reference has been made to either seed production areas or seed orchards. One must remember that these seed production units are the *basis* for eventual production of certified forest tree seed and thus command a major role in any forest tree improvement program.

New York has undertaken a program for certification of forest tree seed. Through the College of Forestry, a committee on seed certification has been established to assist the Commissioner of the Department of Agriculture and Markets in promulgating the standards for this new law. Forest tree seed can still be sold in New York as in the past; however, to be certified, it must meet the newly adopted standards for certification.

The University of Wisconsin, in cooperation with the Wisconsin Conservation Department, has established a program for the verification of forest tree *seed.* This is a step in the direction of eventual production of certified forest tree seed originating from a series of seed orchards comprised of progeny-tested and proved parental material. A proposal for the establishment of a program for certification of forest tree seed used in Wisconsin was submitted to the University Administration in 1952. Although no immediate action was taken, it did lay the foundation for the establishment of a program for the Verification of Forest Tree Seed in Wisconsin in 1956. The program was adopted by the Wisconsin Conservation Department in early 1957. Since then a number of seed tree reservations have been selected and set aside. Roguing operations have been completed in one area and started in a second, and a third area has been marked for cutting. Seed has been collected in two of the areas prior to roguing, and a portion of seed has been retained for testing with seed to be harvested after the roguing operation. Seed derived from these seed tree reservations is expected to enter the commercial trade in increasing amounts as these and additional areas are brought under intensive management for seed production. The seed will be verified as to origin, purity, and germination percent. Eventual introduction of "certified forest tree seed" will follow adequate progeny testing of selected parent trees. This certified seed will be derived from seed orchards being established for that purpose from grafts of the selected and field-tested parent trees. The genetic value of certified seed will be known.

The state has been divided into three main seed collection zones. Every effort is being made to have stock derived from seed produced and collected from seed tree reservations within each general region or zone returned to the general areas of collection for use in reforestation.

Two of the three major zones are divided into an eastern and a western area. One or more nurseries are located within each of the three major zones, facilitating the production and distribution of this verified forest tree plant-stock. Although no policy has yet been established regarding the marketing of the verified stock, the matter is under consideration so that price and distribution scheduling will not be a problem when verified stock becomes commercially available. It is anticipated that any price increase for the premium stock will be modest and yet adequate to cover the increased costs of production.

Cone-picking time studies have been conducted in two of the seed production areas during two different collecting seasons.

In 1957 the cone crop on red pine was moderate in Wisconsin. The two areas from which cones were collected were quite different. In one area the trees were 40 to 60 years of age and ran from 40 to 60 feet in height. In the second stand the trees were older, ranging from 75 to 150 years in age and from 70 to 90 feet in height. In the younger trees with smaller crowns and shorter climbing distance, few cones were obtained; the average collection time for a bushel of cones was less than in the larger trees, and the cost of a bushel of cones was less on the average. This was because the operator "ran out" of collectable cones sooner and thus left the tree for more productive collecting in another tree. In the second area the trees were older, had larger crowns, and thus required a longer climb into the producing crown. Here more cones were collected per tree at a greater cost per bushel of cones collected, the collection averaging about twice as long per tree as in the smaller trees.

In 1960 the cone crop on red pine was moderately heavy to very heavy. The two areas described above were again used for cone collection. This time the cost of a bushel of cones was greater in the younger trees than in the older trees, it took slightly longer to collect a bushel of cones from the younger trees, and few cones were obtained per tree. The details of these collections are shown in the accompanying chart. I will point out, though, that the average cost of a bushel of cones in the 1957 collection was $11.34, while in 1960 the cost was $4.16, or $4.34 if the rate of $1.69 is used as the rate of pay per hour for both years. Although our efforts to date have been modest with regard to the verification of forest tree seed, they offer promise of significant reward from expanded efforts along this same general line. In addition the program for establishing a network of seed orchards is moving forward, and we are confident that this activity will bring a many-fold reward in the not-too-distant future.

Nationally the Society of American Foresters Committee on Forest Tree Improvement has had an active subcommittee on seed certification. This subcommittee has just finished a survey on seed certification for the forest industry. The full report will be presented in a coming issue of the Journal of Forestry. In summarizing these comments, I would like to extend apologies for not mentioning a number of other programs of research currently under way dealing in some way with this general topic. That I must apologize is in itself significant, for it indicates the widespread interest in this field of forest tree improvement. We can expect that in the near

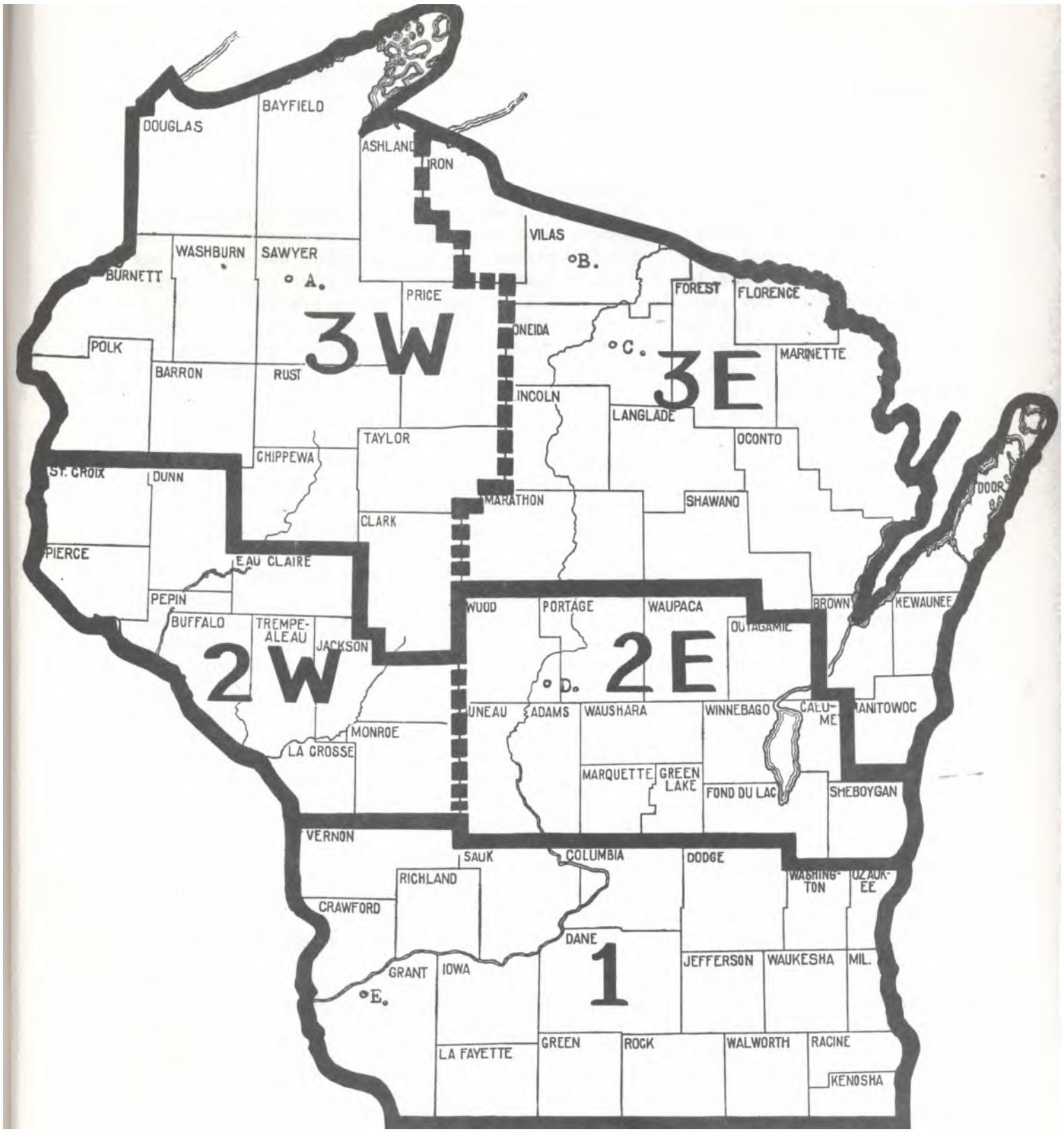
future certification for forest tree seed will be established nationally. Researchers in many lands working on many different species all have the same general objectives in spite of political tensions, namely, improved forest tree species. I am confident, therefore, that the Biblical saying, "By their fruits ye shall know them," could well be paraphrased, "By their fruits we shall grow them and be proud of them."

Cone Collection Data, Seed Tree Reservations
Red Pine, Pinus resinosa

	1957			1960	
	Area I, Wisc.River	Area II, Buckatabon	Area III, Seeley	Area I	Area II
Number of pounds of cones collected	643	210	321	345	233
Total bushels collected[1]	18.4	6	9.2	9.86	6.7
Total hours worked[2]	112	44	78	27.75	15.5
Wages per hour for collectors	$ 1.69	$ 1.69	$ 1.69	$ 1.65	$ 1.65
Cost per bushel	10.29	12.39	14.38	4.64 (4.76)[3]	3.67 (3.91)[3]
Average collection time, including travel to collect one bushel of cones	6	7.3	8.5	2.8	2.3
Number of trees used	82	16	43	28	14
Average pound of cones per tree	7.8	13.1	7.5	12.3	16.6
Average time spent per tree, hours	1.36	2.75	1.8	.99	1.1

1/ Based on a 35-pound bushel.
2/ Includes travel time.
3/ Cost per bushel if figured at $1.69 per hour rate for collectors.

COLLECTION ZONES FOR WISCONSIN VERIFIED FOREST TREE SEED



PRODUCTION CENTERS

A. Hayward State Nursery, Hayward
B. Trout Lake Nursery, Boulder Junction
C. Hugo Sauer Nursery, Rhinelander
D. Griffith State Nursery, Wisconsin Rapids
E. Boscobel State Nursery, Boscobel