PANEL DISCUSSION

THE APPLICATION OF TREE IMPROVEMENT IN THE NORTHEAST - WHY OR WHY NOT?

Gordon F. Weetman
Research forester, Pulp and Paper Research Institute of Canada,
570 St. John's Blvd., Pointe Claire 720, Quebec.

In the fall of 1969 there were two events of importance for tree breeders in Canada. One of these was the publication of an entire issue (December 1969) of the Forestry Chronicle on Tree Breeding and Forest Genetics in Canada. The aim of this issue was "to present, by species, the work that is being done and needs to be done in this field, in relation to the needs of forest management." In this issue, Cam Place (2) outlined why we need tree breeding and what is needed in tree improvement.

The other event of importance was a seminar held for executives of the pulp and paper industry at the Pulp and Paper Research Institute. At this seminar, Bruce Zobel (5) generated an enthusiastic response to a talk on industrial tree improvement in the south. Laurence Roche (3) outlined the program that would be required to "produce for expanding reforestation programs, forest tree seed that is geographically appropriate, genetically superior, and sufficiently abundant." That such a program is likely to be carried out is most unlikely at the moment because, as Roche pointed out, "there are practically no professionals with post-graduate training in forest genetics and tree improvement working for provincial governments and industry in eastern Canada."

Having had the current situation, and need for tree improvement in eastern Canada, so recently dealt with, I would like to give my impressions of why tree improvement is not being implemented in this region.

Let's look at the present situation.

1. With one or two notable exceptions, there is very little industrial practice or research in tree improvement in eastern Canada. With the same exceptions, of course, there is little industrial initiative in large-scale planting programs.

2. There is a relatively small group of Federal forest researchers in this field, mainly working at fundamental research studies.

3. There is little operational activity at the Provincial level. The first proposals for a provincial government program in Quebec have only just been made.

Ontario has had a modest genetics research program for a long time, but it now has a large reforestation program; this program has expanded faster than the tree improvement program needed to back it up.

4. Current practices of the Provinces in the control and use of tree seed are very variable (4). Seed collection zones are very general and a lot of seed collection is still uncontrolled.

All of this is disturbing enough to foresters concerned about the next crop of trees, but in addition, and more important, there is little or no industrial support for tree improvement work. There is no cooperative program between the two levels of government and industry. This is where some action is needed--by the tree breeders.

It is easy to chastise the large pulp and paper companies for their lack of interest. It is also rather easy to do a clinical type of analysis on why this lack of interest exists. In such an analysis, such factors as crown land ownership, excessive forest holdings, easy-going relationships with the provincial governments, short-term planning, foreign corporate ownership, a type of negative selection process in executive recruiting which disfavors forestry department as opposed to operating department foresters, can all be more or less important depending on an individual's position and allegiancies. My personal opinion is that, while a lot of blame can be laid at the companies' door, it is not all their fault--a large measure of the responsibility lies with tree breeders themselves; a contributing factor is the lack of instruction in this subject in Canadian forestry schools in the last 30 years.

Most tree breeders are paid to do research and not to organize programs. This field needs some activists and promoters if it is to be put into practice. I feel the time is riper now than it has been for a long time. Wood demand projections, rising wood costs, plus the current environmental awareness are all causing reassessments of long-held industrial attitudes to silviculture in general and the economics of reforestation in particular. If companies can see a way in which they can jointly and without great expense to individual companies, organize and support a tree improvement program, then they will probably buy it. As I see it, it is up to you to get together to propose and sell such a program.

It is my impression that there is a lot to be learned from the program in the South. They have an approach to a cooperative program that has worked. I understand that some companies are now planting only stock from superior seed. Such an approach will be applicable to those large areas of boreal forest where Dave Smith's "scorched earth" silviculture is being, or will be, practiced.

If companies are getting to the stage where it is considered to be economical to seed and plant in the Northeast, then they must also be shown that it is also economic to use superior seed. They must also be convinced that it takes some time to produce this seed. These points are not as obvious to industry as they are to this audience. That tree improvement is a paying proposition has recently been shown by Carlisle and Teich (1). In a study of the costs and benefits of tree improvement programs, they have concluded that for a white spruce tree improvement program:

1. There is good evidence in the literature that the costs of production of genetically superior seed are more than offset by small increases in yield of 2% to 5%.

2. The degree of improvement in yield (15%) which can be expected by using genetically superior stock of white spruce, results in substantial economic gains. An increase in discounted profit of $8.32 per acre can be expected from improved seed produced at a cost of about 430 per acre to be planted.

3. In the context of a 100,000 acres-per-annum white spruce planting program, an investment in white spruce improvement research of $1,500,000 (including 6% interest) over a 15-year period and an annual expenditure of $23,310 on seed production and collection generate a potential economic benefit of approximately $832,000 per annum.

4. Yields can be increased by improvement in both genetic constitution and cultural methods, but neither can achieve maximum yields on their own.

5. The use of improved genetic material has the advantage that the cost is only incurred once (at seed production) in the timber production sequence, and the benefit is carried over into future generations.

6. Once the research is completed, the costs of production and use of improved trees with faster growth in plantations are small (e.g. 430 per acre) compared with costs of some cultural techniques (e.g. use of fertilizers) aimed at increasing growth.

7. Tree improvement programs not only produce trees which grow faster and are well adapted; they can also produce trees with superior timber quality which can considerably increase mill profits by increasing yield of product per unit volume of timber handled, and by reducing processing costs.

8. There is a need for investigation of problems of administration of genetics and improvement programs to find ways of reducing the considerable expense incurred by loss of research results arising from lack of program continuity and by destruction of seed sources.

9. Plantations are playing an increasingly important role in Canada's forest economy. If Canada is to compete in the world markets with countries capable of achieving very high yields (up to 400 cu. ft. per acre per annum) with trees such as radiata pine, yields of tree species used in Canada's plantations must be increased by all economic means, genetic and cultural.

If tree improvement is to be applied in the forest industry of the Northeast, both in Canada and in the United States, I feel that these conclusions must be sold to industry and backed up with proposals for a cooperative industrial tree program. Such a program does not have to be restricted to either the eastern Provinces or the northeastern States--there would be real benefits in a program which crosses the border.

LITERATURE CITED

1. Carlisle, A., and A. H. Teich. 1970. The costs and benefits of tree improvement programs. Canad. Forest Serv., Petawawa Forest Expt. Sta. Info. Rep. PS-X-20.
2. Place, I. C. M. 1969. Tree breeding in Canada. Forestry Chron. 45(6): 375-377.
3. Roche, L. 1970. Forest genetics in Eastern Canada. Proc. Seminar on Forest Genetics and Forest Fertilization. Pulp Pap. Res. Inst. Canad. pp. 27-41.
4. Wang, B. S. P., and O. Sziklai. 1969. A review of forest tree seed certification. Forestry Chron. 45(6):378-385.

5. Zobel, B. 1970. Industrial tree improvement in the South. Proc. Seminar on Forest Genetics and Forest Fertilization. Pulp Pap. Res. Inst. Canad. pp. 3-26.

Donald F. Strout
Industrial Forester, International Paper Company, P. O. Box 1500,
South Glens Falls, New York 12801

Paper companies in the Northeast, including International Paper, have over the years adopted an empirical system of forest management to insure a future supply of wood fiber for their mills. In our own case, natural reforestation was assured by relatively simple and comparatively inexpensive methods, such as diameter limit cuts and selective cutting in both hardwoods and softwoods. This system has limited us to the native species which have best met the mill requirements. It has been our contention that through our system of selective cutting we were applying genetic principles to the extent that our cutting system resulted in the improved average quality of residual trees. Our foresters have been working to improve our growth rate, the general sanitation, and the spacing of trees. While foresters don't pretend to be geneticists, it is fair to say that historically foresters have always possessed a rather keen genetical sense. A recognition that marked inherent differences exist within a given species is quite likely the reason that our species are in as good a silvicultural condition as they are today. Because our stands were easily reproduced by natural regeneration, the application of an intensive genetic approach was considered unnecessary and economically unsound. We could always get any additional wood needed by paying a modest increase in transportation cost.

In order to focus on why we have been unresponsive to advances in genetics and the use of planted stock here in the Northeast, a little background on landownership, mill requirements, and a few economic factors may be helpful.

Our Northern Woodland Division has the responsibility of supplying wood to four mills--one in Maine and three in New York State. One-third of this wood comes from Company lands and the remainder is purchased from outside sources. Presently, these mills use a wide range of species. The Tonawanda, New York, Mill uses poplar and most hardwoods. The Hudson River Mill uses spruce; fir; poplar; and, for the first time this year, red pine. The Ticonderoga, New York, Mill uses practically all species of northern hardwood. Our new Androscoggin Mill in Maine uses spruce, fir, pine, hemlock, native larch, and practically all hardwood species. Thus, at one mill or another, we use the full range of species growing in the Northeast.

This has not always been the case. Recently, we have changed from mills having a sulphite manufacturing process to mills having the sulphate process. Our sulphite mills, the last of which was phased out in 1965, were dependent on spruce, fir, and poplar. We have been through a major change in manufacturing process which has released us from an era of almost single species use to a new era in which almost all species are being used. The era of the sulphite mill with its limitations to two or three select species was not a problem era in terms of available wood. The species required were in surplus both on our own land and in the marketplace. Total mill requirements, in terms of today's mills, were very modest. We were not being pushed to find wood to meet our mill requirements. It was not

necessary to explore new fields of forest management involving genetic improvement and the use of planted stock. Markets just didn't exist for all of the wood that was being grown naturally.

There were additional economic considerations that helped to shape the forest management decisions during this time. One was the low value placed on forest land. Within the last five years we have seen a major change in land values. In the past, we have dealt with such low land values that you could buy land and timber cheaper than you could plant and grow trees on land you already owned. It is obvious that under an economy of cheap land, one isn't required to devote the same effort to timber management and intensive forest practices as under an economy of land shortage and rising land prices. This era of cheap land is behind us and forest land is rapidly becoming scarce while that which is available is expensive with the prices escalating rapidly.

Another factor that favored the application of extensive forest management rather than intensive management during this same period was the favorable transportation rates that existed. The impact of reasonable and stable rates was to encourage the procurement of wood in areas remote from our mills. It also helped to increase the available fiber by extending the range from which we could draw wood. The situation today is that we are faced with escalating freight rates that are beginning to make this same remote wood look economically unattractive.

These economic influences have been and are in a state of change. Our manufacturing process has changed, bringing with it new manufacturing plants with expanded wood and species requirements. The new mills are creating two management problems. We are finding it more and more difficult to recruit the necessary woods labor to procure the increased requirements. We are also finding it necessary to procure wood from greater distances from the mill. On top of this, the cost of long-distance wood is rising rapidly because of increasing freight costs.

Long-range forecasts for the Nation indicate that by the year 2000, we will have to produce twice the pulpwood we now produce. That's a large order. Even though substitutes for wood may reduce the per capita consumption as much as 25%, the increase in population will be so enormous that the annual wood requirements will still be tremendous.

What is the answer to the problems resulting from these changes? The answer is not a simple one. However, one answer that seems obvious is to seek means of producing more fiber per acre closer to the mill. As we see it, the production of an increase in fiber should be a two-step approach, namely:

1. What can be done immediately or for the "short term" to increase fiber production per acre?

2. What steps can be taken now that will assure increased fiber production per acre in the future or for the "long term"?

For the "short term" there are interesting developments in equipment design that offer hope for increased yield through more complete utilization. The trend to tree length logging is an example of recent changes in operating methods and equipment design that have resulted in increased yield per acre. There is a processing machine on the market that will chip the total tree, limbs and all. According to some authorities, using the bole and limbs of a tree could result in an increased yield of as much as 10%. This type of yield is an immediate gain from each acre operated compared to the gains from planting which accrue only to

those acres actually planted. The problem with the total tree utilization concept is that research has not as yet solved the bark problem. Planting, if begun today, would require at least a twenty-year waiting period before any increased yield could be realized. Long before this period is up, the problem of bark separation will probably have been solved, either through the acceptance at the mill of more bark or the actual separation of the bark from the wood in the forest, resulting in some "short-term" gain in yield.

As we review the steps necessary to obtain "long-term" gains in fiber production, one approach might be the correction of soil deficiencies through fertilization. Present forecasts are that with the next decade the necessary diagnostic, prescriptive, and application skills will be sufficiently developed to permit the general application of fertilizer. We have not as yet engaged in any fertilization work on our lands, but we are supporting in Maine a cooperative fertilization program to determine if the productivity of certain typical spruce-fir lands can be increased economically. The program is being jointly sponsored by industry and the University of Maine.

One other step that leads to "long-term" gains in production of increased fiber yield per acre will be the use of genetically improved planting stock. We are already working toward increasing our production through silvicultural means on Company land. We see little chance for any additional material gain in this direction. It is possible that the gain that is made may be lost by changes in harvesting methods. As labor costs increase and new harvesting equipment is developed, the result could well be a change in our spruce-fir management from all-age management to even-age management. Such changes, if they occur, are bound to negate some of the silvicultural work done in the past. While there certainly will be silvicultural improvements, it is difficult to evaluate what their contribution will be.

In preparation for a "long-range" program in the field of genetic improvement, an industry-wide meeting was held in Maine in 1967 to explore the need for a spruce-fir tree improvement program. The purpose of this meeting was to elicit support for a joint program involving industry, the Northeastern Forest Experiment Station, the Maine Forest Service, and the University of Maine in a cooperative effort to establish spruce-fir seed orchards from superior trees. This initial meeting was a success. An action committee was appointed, and under the leadership of Art Hart, the program got off to a good start. Due to Art's untimely death and failure of seed crops, the program met with some setbacks, but recently it has been revitalized. We hope to see a speed-up in the program and the ultimate achievement of seed orchards from which superior seed and superior planting stock will be made available.

The economic situation today has still not reached the point where industry in the Northeast is ready for a major spruce-fir seeding or planting program. However, if seed or planting stock were available, industry could be expected to experiment with it on at least a modest scale. We recognize that programs of this nature are never started soon enough, and any experience gained before it becomes necessary to engage in a full-scale planting program would be invaluable.

Perhaps too often overlooked is the problem of obtaining real gains from planting with improved stock caused by the slowness with which one is able to obtain a substantial increase in yield. For instance, if one planted with improved seedlings the 1 or 2 percent of his holdings cut over next year, one would still have 98 to 99 percent of his land growing wood at the normal rate. In other words,

you can only capture gains from tree improvement on the acres actually planted with improved seed or stock. There is no simple way to circumvent this constraint, but it illustrates very well that the road to increased production through genetic improvement is slow indeed. It is obvious that one can never get started too soon to realize increased yield from genetic gains.

It will be of interest to you that as part of our preparation toward a "long-term" gain in yield, we are presently studying the advantages of planting larch in Maine on lands within reasonable trucking distance of the mill. We have already observed planted larch in Maine on lands of others, and have been impressed that it lives up to its full potential when planted on good sites. As we view the economics of planting larch, preliminary figures suggest we can grow it cheaper than we can grow spruce and fir on our own lands in northern Maine and pay the cost of rail freight to the mill.

In summary, I have tried to review the reasons why in the past it has not been economically feasible for us to have been more actively engaged in tree improvement. I have also attempted to show you the changes that have occurred, and are still with us, that have brought about an active interest in genetics by the industry. We now feel we must make more use of the potentials of genetics as they relate to tree improvement. We have made some initial steps which will involve us more actively in genetics and feel that this is just the beginning.

George W. Weiland
General Manager-Timberlands, Dead River Company, Bangor, Maine.

To corectly introduce my viewpoint on "The Application of Tree Improvement in the Northeast - Why or Why Not?", I must tell you first what I do or perhaps better stated, what the company I work for does and what its policy is, lest you may think my remarks are provincial, prejudicial, biased, and unreasonable.

Dead River Company is a diversified business enterprise--that is what used to be called conglomerate a year and a half ago. We are based in Maine and operate in many areas of Yankee enterprise--seafood and lobsters; petroleum products; timberlands; recreation; sawmills; potato farming; precision products; housing; and, I suppose, by tomorrow something else.

I am a practising forester working for this company and am on a team--known as the Timberlands Division--that manages some 300 thousand acres of forest land in the State. The owners and top management of Dead River have set down very specific goals and objectives for our Division: The goal is to remain a financially sound, asset-oriented business, maintaining a sense of stewardship over its land and timber, using them prudently to provide an operating base and resource supply for the future. In today's parlance this would definitely imply a respect for the environment.

Our objectives are to maintain a two-fold status as (1) a progressive and advanced timberlands operating unit developing and utilizing state-of-the-art scientific methods, and (2) a forestry enterprise maintaining and requiring the maximum return on fiber produced.

As it was more succinctly put by Curtis Hutchins, Chairman of the Board, "All I want you guys to do is have the best Tree Farm in the Country!" -- simple, straightforward, and at rare times almost possible to accomplish.

So in everyday terms, we grow trees, cut timber, sell forest products at a profit, all the while being good stewards of the company's land and timber resources.

This all takes place in an interesting setting. In Maine there are 17.2 million acres of commercial forest land--this gives us as a State about 3½% of the U. S. timber business. For quite a few years, Maine's annual cut has been equal to about half of its timber growth. In 1969, the total cut, expressed in cords was about 3½ million, and I suspect this was slightly over half the annual growth.

On the surface, this would appear to be a comfortable position. Who needs applied tree improvement under this condition? If we were smart enough to maintain the existing state of affairs, we certainly wouldn't need tree improvement. For some reason, however, events don't stand still even in rural Maine. We see each year logging costs increasing faster than productivity. We keep experiencing cyclical woods labor shortages.

There are also statistics to show that parts of the state's total wood supply do not have the favorable cut and drain balance that I mentioned previously. Both hardwood and softwood sawlogs are diminishing in size and quality and there is reason to believe the demand for hardwood pulpwood will accelerate much faster than supply and could in a decade outstrip the present hardwood yield capacity of the land.

We also see over-cutting on many of the smaller ownerships.

These local imbalances, plus the fact that Maine's timber falls within the total projected scarcity for the nation, should be enough to cause us to wonder soberly how the job of supplying enough wood can be accomplished. Complicate this further with all the people who will want to walk around and look at trees, listen to loons, breath clean air, and swim in unpolluted water, and you realize we have an interesting time ahead.

So today we perhaps are fat and happy, locally getting a job done, experiencing acceptable returns on investment, generally not degrading the forest ecosystem but enhancing it by our timber growing and harvesting practices. However, by no stretch of the imagination can we afford the luxury of putting our heads in the sand.

Resource managers know full well that, as John Galsworthy put it, "If you do not think about the future, you cannot have one!"

It is my belief that, in Maine, forest managers have a pressing need to sort out the means for perpetuating and embracing our renewable forest resource and to establish priorities to ensure that the job will get done under what will be a demanding blend of economics and ecology.

As to means and priorities, I would put them down in the following order of importance:

1. Fuller utilization.

2. Improved protection.

3. Application of higher yielding cultural practices among which would be tree improvements.

Obviously, life is not simple enough to allow us to take these a step at a time. These means and priorities will overlap and hopefully augment one another.

I put fuller utilization at the head of the list because it is my opinion a good case can be made for this both economically and environmentally.

Remember, I stated we are only cutting half our growth in Maine. This relationship is, of course, good for areas that are understocked, but it is a waste where mortality and natural degradation are taking their toll in inaccessible, over-mature stands. Thus, accessibility--specifically, more and better roads--would provide better utilization and at a price we can afford to pay.

Also under utilization, I would mention better inspection of cutting operations to ensure a clean-up of what is cut.

In addition, we need a more aggressive marketing program that will encourage utilization of all our growing species.

Finally, under the subject of utilization, I believe research should now begin on handling and using small diameter timber--both topwood and small trees. If we can lick this one, we will not only have more fiber available to us from our present forest, but the use of small diameters will augment silvicultural regimes that we will most certainly employ in the future.

I have placed improved protection as the second priority in the development of our forest resource. This is certainly not the glamour area of our business. Workable fire protection procedures have long been established and anything that works and has been around a while seems to get little attention these days. On the other hand, the insecticide-fungicide contribution to protection is really catching the devil. So we must have new ways and better ways to protect our timber crop. Suffice it to say a stand saved adds to the wood bank from which future withdrawals can be made. A stand lost must be paid for now and in the future.

Now to the subject at hand, and what I would put as third priority--<u>application</u> of higher yielding cultural practices including tree improvement.

As most of you will know, we largely depend on natural reforestation for successive crops of timber in Maine, and this ties in very well with our practice of selection cutting. As scattered groups of mature trees are harvested, seeds from remaining trees establish reproduction in the openings, if it has not already been established. The prime mover here, of course, is Mother Nature, and foresters serve about the same useful function as that of expectant fathers.

Biologically speaking, we are not fighting nature with this system, but augmenting the natural potential of species and site. The selection method can be applied intensively or extensively. Hopefully, our management can be intensive with at least 20-year cutting cycles, and remember, these frequent visits to the stand are not expensive silvicultural treatments but rather they are harvest cuts generating a profit to the landowner.

What I am trying to say is that our present method of managing the northern forest is adequately meeting the demands for forest products and the forest has an existing surge capacity which can be tapped when mill consumptions expand. Furthermore, I do not believe the state-of-the-art of intensive silviculture for the Northeastern environment is far enough advanced for broad-scale application.

Now, going back to my statement that selection cutting "augments the natural potential of species and site," I would like to have said, "it maximizes the site potential for wood production," but I am afraid it does not.

To do this, we must be hard at the research and pilot projects that will transform the gleam in a forest geneticist's eye to applied silviculture.

Tree improvement is but one of many areas needing intensive promotion. It is, however, the subject today, and I would, therefore, like to offer the following--not as humble suggestions, but as brash charges to a very talented and dedicated group.

I can do this because, as you must suspect by now, I don't know the difference between a half-sib progeny and a polyploidal chromosome.

Number 1. You tree improvers and forest geneticists have something that has to be sold. I know you have had success in the past--broad success in the Southern region because timing and conditions were right and isolated success in the Northeast--but overall, I don't think you have sold your wares well enough.

I believe you have two customers to sell to: (1) your brethren in the forestry profession; and, perhaps more important, (2) those in top private and public management who set policy. If you convince your fellow foresters of the worth of your projects, they will effectively help you sell at the front office.

Number 2. A corollary to better selling is better communications. This Conference is an example of good communications, but you are talking to yourselves. Among your numbers, I have heard you exclaim no one reads what we write or bothers to listen to what we have been saying for years.

Don't quit, don't give up! Keep telling your story and do it better and in unique ways.

I would like to see a practical handbook published on the subject of tree improvement. Ernie Schreiner tells me he is about to get at such a project. Dave Cook's book on larch is an excellent example of what can be done.

Very frankly, the majority of management foresters will not read your erudite publications--maybe the abstracts.

Why not a short course on the subject at one of the Northeastern forestry schools. These are in vogue today, and I think a fine way for men who have been out in the field to keep up on things.

Since coming back to New England--some 3½ years ago--I've heard very little about tree improvement at the S.A.F. section meetings. Have you given up?

Number 3. After Prof. Schreuder's fine presentation, I somewhat hesitate to mention my third suggestion. But, going on the popular theory of letting it all

hang out, I would ask your members to work closely with forest managers and develop, through the best operations research techniques, bench marks to guide us when tree improvement applications will become economically and environmentally feasible.

For example, with regard to forest fertilization, our present numbers indicate that with $20/acre application cost and assuming a response similar to Scandinavian results, we will have to receive an average of $10/cord stumpage under present cutting methods to make it pay off.

Number 4. Why not a revitalized cooperative approach in the Northeast similar to the gigantic effort--excuse the pun--that bore fruit in the Southeast?

We now have a cooperative fertilization project at the University of Maine. This is financed by 12 landowners and has a 5-year subscription of $70,000. It is being implemented by three staff members of the School of Forest Resources at Orono. I believe this approach points the way to very efficient solution of area-wide problems.

Also try knocking on industry's door for support in applied research and pilot projects. I am certain this approach will help refine the economic bench marks that will tell us when to bring various tree improvement regimes on stream.

To sum up--I would paraphrase Wally Schirra's railroad commercial, "Who needs applied tree improvement? --I do, you do, we all do!", but I would emphatically add,"within the correct framework of economic and environmental priorities!"

WEETMAN - Well, you've heard your guests give you an outside opinion. They haven't been easy on you. You've heard three position papers, two company and one institutional. The title of this panel discussion is: The Application of Tree Improvement in the Northeast -- Why or Why Not? It's obvious that tree improvement has low priority in the industrial view compared to problems of alternate supplies of wood, logging cost problems, etc., and it looks like you have a selling job to do. Now, are there any questions for panel members please.

LEDIG - question for Don Strout. It is true that if you were planting only 2% of your acres this would not result in much gain very quickly. Still, if this was profitable, wouldn't you go ahead and plant the acreage?

STROUT - I'm not saying that you don't go ahead and plant--I'm just saying that this takes a long period. There's a long period involved here before you can realize a gain from it. There's no reason not to go ahead and plant; it just requires additional planning ahead to recognize that what you do today may be 20 years from now before you are going to realize this gain.

GLADSTONE - Another question for Mr. Strout. Would you give me an idea of what the tonnages of the four mills you listed are, and how is larch accepted at the mill?

STROUT - We use native larch at the Androscoggin Mill and this comes in as a mixture with pine and hemlock and 36% of the utilization there is a combination of larch, pine, and hemlock. I'm not sure of the percentage of the larch. At Ticonderoga, when our mill was using softwood as well as hardwood, we were accepting larch along with pine and hemlock in whatever proportion we were able to obtain. We've had no problems with it. In fact, we find the yield is very good. The quality of the stock produced from larch by the sulfate process is very acceptable.

GLADSTONE - About how much production are you talking about? One thousand tons per day collectively, or 2,500 tons per day collectively?

STROUT - We're talking in terms that if we use larch, it would be at the Androscoggin Mill, and we use some 500,000 cords of wood a year there at that mill. I think if we can produce that amount of larch, we might consider using it.

LEDIG - I'd like to ask Mr. Weiland or Mr. Strout whether their companies do any trial planting whatsoever, if they have any cost figures on this, and what planting methods they use, if they do plant?

WEILAND - This won't take long, Mr. Strout. Cost figures are immaterial. There are very few abandoned fields. We have planted most of them. We're talking just about 30 acres of land. That's the extent of it. We are contemplating clearing some land this fall, and with the suggestion of Ernie Schreiner doing some planting of, hopefully, genetically improved stock.

LEDIG - What species?

WEILAND - We'd like to try both softwoods and hardwoods. We don't know what hardwood at this point. Probably larch in the softwoods.

TRIP - I would like to address a question either to Mr. Weiland or Mr. Strout. It seems to me that for the last 300 years people have been cutting the better trees and taking things out of the forest. The commercial outfits are still doing the very same thing, taking the best trees (which would be the reverse of tree improvement) and they are taking material out of the forest without putting anything back; in reverse of good cultural practices.

STROUT - I don't know if this is exactly the way it works. In our Maine area dealing with spruce and fir management, we are marking all of the spruce-fir stands and all of the wood that goes into the pulp mill. It is our attempt in marking these trees to first remove defective trees, to improve the spacing, eliminate fir of the lower diameter, and leave better spruce. There is no guarantee that these are genetically superior spruce trees. In terms of the quality of spruce being left, we are leaving some of the better spruce trees that are in the stands. It is our feeling that on a very extensive approach, we are not deteriorating the stands, at least we are maintaining them in the condition they're presently in.

TRIP - When did that shift come about would you say? Is that a general practice now?

STROUT - It's been a general practice on our lands for a number of years to mark all of our timber--all of our spruce and fir stands for the wood that's being delivered to our Androscoggin Mill. We are cutting sawtimber in some of the areas that are remote from the mill where we don't mark. But where it's economically attractive to deliver it to the mill, we do mark it. On the sawlog cuts, we use a diameter cut where we specify a low diameter on the fir and a much higher diameter on the spruce. And we think we are getting a reasonable result on this rather extensive practice.

SCHREINER - I think the question here was directed to the possible dysgenic effects of logging in the United States, particularly in New England. I've seen some drastic dysgenic affects in the Pyrenees of Spain; acres of spiral-grain Scots pine left because it couldn't be used for quality lumber. In the vicinity of one little village in Bougois, small saw mills have been cutting pine for at least 500 years. There is practically no advanced regeneration at the time of harvest cutting. The new stands were regenerated by the spiral-grain trees that were left. This is not the case in New England. Ever since the King's broadaxe marked the pines for ship masts, we have had advanced regeneration; the progeny of the good trees that were cut were maintained. I don't believe we've had any dysgenic effect. I believe we can find genotypes as good as those that were living 300 years ago. It probably is different in Europe; they've been cutting their tinter for 1,000 years or more. We haven't been at it long enough to do much damage, and we have had different forest types in which we had advanced regeneration before we cut the parent trees.

TRIP - So would you say that the present situation under which we have trees that are not nearly as large as they were when the first Europeans came to these parts is strictly a matter of environmental deterioration rather than genetic?

SCHREINER - That's right. The reason we had bigger trees then is because the Indians didn't have sawmills.

CARLAW - Didn't you say the difference is a question of time to grow, rather than the deterioration of the ecology?

SCHREINER - I thought Trip meant individual trees of large size due to age.

TRIP - It's not just the age. You just can't grow trees in the same places now as they were growing 200 to 400 years ago. To the same size--just can't be done. You can't possibly grow a redwood in the San Francisco area right now, and that was one redwood forest at one time.

SCHREINER - That's true, but there's a big difference between the California climate and ours. I don't agree that what you say is true here. If you're talking about degraded farm land, the answer is yes. It doesn't have the growth potential at the moment that forest land had 200 years ago. You realize, of course, that I suspect half the land on which we're cutting pulpwood here in the Northeast was once a pasture or cultivated field.

CECH - What did it regenerate from--all this land that was in pasture?

SCHREINER - It came in from trees along the fence lines and so on.

CECH - Which were pretty poor.

SCHREINER - They didn't clear thousand-acre lots. They were small fields and pastures; they had to because of topography.

CECH - Would you say that the Northeast is different from any other part of the country?

SCHREINER - Well it surely is different from the South and from California; wouldn't you say so?

CECH - I mean the management practices that have been used.

SCHREINER - The managers in the Northeast have been very fortunate because nature did their managing for them.

SCHREUDER - It seems to me that one of the points the panel has been telling us, or at least implicitly is telling us, is that industry still looks most at short-run when it comes to economic considerations. One of the things we have to try to do is to convince industry to look at the long-run. I think tree improvers aren't the only people that face this problem. Do you have any suggestions or thoughts about ways of going about and doing this? In other words, how to convince in particular, plant management (which generally looks at projects which last only 5 years which is typical of mill equipment life, product prices, and markets) to look beyond five years. For woodlands, you have to look beyond that.

WEETMAN - This has been a fundamental problem in forestry practice or lack of it in eastern Canada. One approach to it is to expose the executives of industry to enthusiastic scientific workers.

SCHREUDER - The trouble is, though, that industry has to take some short-run view because it has to survive.

WEETMAN - But, once a company can see that its future wood supply is going to come from a certain area of forest and not from all sorts of alternative sources of supply or alternative species, once it's fixed that this mill is going to get its wood from that piece of forest and there's not much choice about it,

then the company is in a position to really seriously consider growing wood. Now, not all companies are in that position, but a lot of them are getting much closer to it. My opinion would be that now is the time to make these proposals for tree improvement because by the time most companies are in this position, we'll then have the tree improvement ready for them to use. But you have a selling job to do to persuade the companies of this position.

SCHREUDER - I'm just wondering whether the economic rate of return is going to be a convincing argument to them if they see this. The present situation will last a long time.

WEETMAN - I doubt somehow if you can really sell a tree improvement program on current economic calculations. You've got to sell it on a good deal of faith and the enthusiasm of the workers--on the trust that the industry has that this group of men are going to produce something in time, and that this is basically a good thing to do. That is my feeling. I don't know how the other members of the panel feel about it.

HOCKER - Is industry aware of the demands which are being placed on research groups for information--information which is other than timber production oriented? In other words, there is a tremendous demand for environmental improvement, for short-rotation Christmas trees, for trees which have aesthetic value which could be used for purposes other than timber production. Industry says, "Okay, go ahead and work and 10 years from now we might use what you have." But, it might be too late 10 years from now because the research talent which is developing today might change emphasis to the point where the results of their research will be directed toward growing trees for campgrounds, or Christmas trees, or for street trees and uses other than timber production. I'm saying this because many of us present now are assessing our research programs, and we are trying to decide which direction we should go. There is a trend now, particularly in agricultural experiment stations, to diversify and grow in directions other than timber production.

WEETMAN - Well, industry hasn't exerted its pressure upon you because they don't see the need, but nevertheless, I think you can anticipate it.

HOCKER - You say industry doesn't want tree improvement now; they might want it 10 years from now. But, if the people that might be encouraged are not now encouraged, it might be that when there is a need, the information won't be available.

WEETMAN - Then you'll have to tell industry this and tell them that you're available to do some work and if they don't tie you up now, they will lose you. I think that you had better make this proposal to them.

WEILAND - I think it's a two-way street. We have to do a better job telling you what we want, but I don't think that it's true that our attitude is: "All right, 10 years from now we'll have a problem and we'll do something about it then." I think we recognize today that we will have a problem 10 years from now, and we do recognize that things have to be started now. Whether we have told you or not, I'm not so sure. Apparently we haven't. The lines of communication have not been open. This is why I am a real proponent of the cooperative research approach, like the one I've mentioned in Maine on fertilization. I think that this is the way to do it. Another example is the geneticist's approach in the South with industry.

DIG - Each of the short-term approaches that the panelists have mentioned would really pay off much better if they were combined with the genetic approach. talked about protection, and you mentioned the problem you have with fungicides and insecticides. All right, the simplest form of protection, of course, is a resistant tree--if you can develop one of these, you wouldn't have your problem (which will get worse in the future) of the use of pesticides and insecticides.

Fertilization is talked about by a lot of the industries. Remember that the yields of hybrid corn were not totally from the use of genetics, but also from the use of new cultural practices--namely fertilizer. A corn was bred which would respond to fertilizer applications. We see the same thing in trees--in loblolly pine and slash pine. Some individuals or some families respond four times better than the average to fertilization, some not at all. In fact, some are just about killed-off by application of fertilizer. Certainly we would get the greatest gains out of fertilization in the future if we bred a superior tree to go along with new cultural practices.

WEETMAN - This particular point really caught the imagination of industrial executives at the meeting we had last fall in Montreal. The fact that some trees would respond much better to fertilizers. This really impressed them.

DORN - You indicated that there is a fairly substantial tree planting program in Canada now. Who's planting most of these trees? Are they private owners or the provinces?

WEETMAN - The biggest program is in Ontario, and that's handled on crown land, using stock raised in provincial government nurseries. Contracts are signed with companies, and the government pays for the planting but uses industry labor and equipment. It's all financed or paid for by the provincial government.

LEDIG - We have a man from New Brunswick in the audience, Mr. Stephen Manley, who's familiar with Mr. Irving's operations. The Irving Company is doing quite a bit of planting. Perhaps he could tell us something about what they're doing in New Brunswick.

MANLEY - I'm afraid this is going to be quite a criticism of what you've had to say, Dr. Weetman. One aspect of the private sector that you failed to mention was the operations of Mr. Irving, our industrialist in central New Brunswick. It would be a fair estimate, I would think, to say that Mr. Irving owns a considerable portion of the province. Maybe I see why Mr. Irving didn't want to come to the meeting; I think he's got the jump on everybody, whether it's through economic considerations or through his enthusiasm--but whatever, he has the competitive edge because right now Mr. Irving is planting much of the land he cuts. He attempts to plant the year that he makes his annual cut (a cut which is considerable and larger than any I've heard about here). I don't have the figures because I'm not one of Irving's foresters. A minimum of planting sites are old farmland, and he uses very little machinery. I'd like to give you an idea of the method he uses. His operations are an indication of his thoroughness and cooperation of federal, provincial, and even other industrial foresters. Initially, Mr. Irving got started out without any tree improvement in mind, but they ordered a large crusher, I believe it is LeTourneau. I don't know the company, but one of the people here from the Southern states may. He has a 40-ton crusher go into the stands that he has clearcut, and this is the only site preparation, I understand, which is done. The crusher runs the area, and seedlings are planted. He has also made his own nursery, produces his own seedlings, and collects his own seed. He has such a wide planting program that he runs out of seed occasionally and has tried

to order seed. The purchased seed in some cases comes from Kapus Kasing, which he finds undesirable and prefers the local provenance. Because of Irving and provincial demand for black spruce seed, federal and provincial agencies are now beginning a black spruce selection program. We're trying to locate plus stands of black spruce seed and produce our own seed in New Brunswick for distribution to both provincial agencies and to Mr. Irving. It's unfortunate that the industrialist couldn't come or send a representative, because it certainly is an extensive operation. I would be pleased to try to answer any questions anybody asks, because from what I can gather at the meeting, it's almost a unique situation.

DORN - What species does he plant?

MANLEY - He started out originally with white spruce, red spruce, black spruce, and some jack pine. Right now, he's concentrating his efforts on black spruce. I mentioned the black spruce selection program. He's found that this species has a very rapid juvenile growth, and he's aiming at a very short rotation. The species is well suited to this. It's a real sprinter at the start, but may slow down at 30 years--but he's not interested in what happens after 30 years. He is also contemplating fertilizing some of these relatively young stands, but hasn't done so yet. Right now he would like improved black spruce seed, and he's working in cooperation with the federal government on selection programs.

KITTELSON - Did I understand you to say that all of this was hand planted?

MANLEY - When I visited this operation as a student (this operation has been going on at least since 1963-1964), the planting situation was like this: K. C. Irving had all his cutters in the slack part of the year, usually the spring, divided up into groups of 10, paid them almost the same wages they were paid at cutting pulp, and they planted the entire area that was mowed down by the crusher. I don't want to defend, or I don't want anybody to take verbatim what I say. It's simply what I, an outsider, understand of the operation. As I understand it, Irving wants to concentrate the fiber in single stems, and he wants to cut it somewhere between 25 to 35 years, and I think he's going to do it in about 25.

WEETMAN - If you want to see Irving's operations, the Northeastern Forest Soils Conference will be visiting that operation next summer, and you can have an organized tour of it.