U. S. DEPARTMENT OF AGRICULTURE
MISCELLANEOUS CIRCULAR No. 39

Report of the National Conference on Utilization of Forest Products

WASHINGTON, D. C
NOVEMBER 19 and 20, 1924

This conference feels that forest conservation has suffered a serious loss in the death of Secretary of Agriculture Henry C. Wallace. It is our belief that his high purposes in calling together representatives of all the forest-using industries, technical societies, the press, the schools, the consumers, the Government, and the general public to create a program for reducing timber waste will in time be realized and brought to fruition. He was an upright and able public servant, and this conference has sorely missed his counsel and leadership.—*Resolution adopted by the National Conference on Utilization of Forest Products at its afternoon session, November 20, 1924.*

Issued April, 1925

U. S. DEPARTMENT OF AGRICULTURE
MISCELLANEOUS CIRCULAR No. 39

REPORT OF THE NATIONAL CONFERENCE ON UTILIZATION OF FOREST PRODUCTS

NEW NATIONAL MUSEUM
WASHINGTON, D. C.
NOVEMBER 19 AND 20, 1924

"We hold the resources of our country as a trust. They ought to be used for the benefit of the present generation, but they ought neither to be wasted nor destroyed. The generations to come also have a vested interest in them. They ought to be administered for the benefit of the public. No monopoly should be permitted which would result in profiteering, nor on the other hand should they be indiscriminately bestowed upon those who will unwisely permit them to be dissipated. These great natural resources must be administered for the general welfare of all the people, both for the present and for the future. There must be both use and restoration. The chief purpose of this conference is to discover policies which will, in the hands of private individuals and of public officers, tend to further advancement of this already well-defined and securely adopted principle."

—*President Coolidge.*

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MISCELLANEOUS CIRCULAR NO. 39

WASHINGTON, D. C. APRIL, 1925

REPORT OF THE NATIONAL CONFERENCE ON UTILIZATION OF FOREST PRODUCTS

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FOREWORD

The National Conference on Utilization of Forest Products met in Washington, D. C., on November 19 and 20, 1924. It was called by the late Secretary of Agriculture, Henry C. Wallace, for the

purpose of formulating a program to combat timber waste in all stages of manufacture and use. Secretary Wallace pointed out that timber waste constitutes a serious and in large measure unnecessary drain on our diminishing forests, and that we have a great deal of practical knowledge on better methods of manufacturing and using timber, but that this knowledge is not being effectively used.

The conference was made up of about 500 representatives of a wide range of forest-using industries, timber consumers, and organizations interested in forestry, including timber owners, loggers, and lumbermen, wood-using industries, railroads, mining industries, farm organizations, pulp and paper industries, publishers, advertisers, chemical industries, engineers, architects, engineering and forest schools, State foresters, forestry organizations, chambers of commerce, banks, and other groups.

The conference adopted a report, given in full on a later page, recommending the creation of a central committee on utilization of forest products, and a program of better utilization to be guided by this committee.

This volume sets forth the salient features of the conference.

FOREST THRIFT

By PRESIDENT COOLIDGE

This conference has been called for the purpose of further attempting to deal with the problem of our national timber supply. One of the chief items in that problem is the present appalling waste. Some of this waste may be unavoidable—to a large extent it is unnecessary. The time is at hand when our country is actually confronted with a timber shortage. That can be remedied in only two ways; by diminishing the present waste and increasing the present supply.

It is significant that this conference was called by the late Secretary of Agriculture, Henry C. Wallace. It was the outcome of a broad forest policy which he was engaged in developing, and to which he contributed so much ability and energy. It was, he hoped, to lead to such care in the manufacture and use of our forest products that we could greatly lessen the severity of the prolonged timber shortage of which we are entering the first stage. If this conference can forward his purpose there could be no more worthy tribute to his devotion to forest conservation. Others may have equaled him, but American forests have had no better friend than Secretary Wallace.

Busy men and women who drop their personal affairs and lend their counsel to a public conference come with the expectation that they can accomplish some tangible results. The Government is going to ask you to consider definite plans for reducing timber waste. It is going to suggest that out of this conference shall emerge a program of specific action for timber-saving rather than a mere expression of ideas. Containing as it does leaders from every branch of forest industry and from many interests closely allied with forest industry, this conference has, I know, the ability and the will to create such a program. It is not my purpose to discuss these specific measures, but to give as a background for your consideration some of the facts that force us to adopt a drastic program of forest thrift.

The era of free wild timber is reaching its end, as the era of free wild food ended so long ago. We can no longer depend on moving from one primeval forest to another, for already the sound of the ax has penetrated the last of them. We like to think that it took three centuries to harvest these immense forests. It is comfortable to believe that they will last indefinitely still. But in reality we have cut most of our timber, not in the past 300 but in the past 75 years, to serve the great expansion of population and industry, and there

is no reason to expect a decline in the rate of cutting as long as the forests last.

What has given us this illusion of permanency? First, our stored timber which could be drawn on with increasing speed and with the appearance of plenty until the last stick of it should be gone. Secondly, a transportation system that has permitted our sawmills to follow the retreating forests and to ship their product to distant buyers. Our markets have been full of timber. Only in the higher cost, the long haul, the near exhaustion of certain kinds of wood, and the sharply falling per capita consumption have we dimly sensed the dwindling of our forests.

We do not know the forest situation down to the last acre and board foot, but we know it well enough to make us think and act. Of the old forest the first explorers met we have in area only one-sixth left, and in bulk of timber less than one-third. From overcutting and fire we have left on our hands something like 80 million acres of denuded forest land, most of it unfit for farming. Then we have about 250 million acres of second-growth forest, much of it poor in quality and amount. Three-fourths of our cut is still from virgin forests, difficult and distant of access, so that their products must pay for long freight hauls to reach the chief markets.

Expressed roughly, we have left about 745 billion cubic feet of timber. From this the annual drain is 25 billion cubic feet. This total drain is most significant when we reflect that, toward offsetting it, we have an annual timber growth of only 6 billion cubic feet; and even in our young forests, where this growth is taking place, cutting has already outstripped growth. We must face the situation that at this rate we are not far from timber exhaustion.

To bridge this fatal gap between cut and growth we have never taken sufficient action. In fact, our wealth of old-growth timber has made us prone to ignore the gap and to leave our less fortunate descendants to struggle with it. But we can not escape the penalties of our national neglect. They are already beginning to be felt. Since 1870 lumber prices have risen much more rapidly than the prices of other commodities. Per capita annual consumption of sawed lumber, which in 1906 had reached 525 board feet, has dropped to 285 and in some of the Eastern States to 160 board feet. We are paying a yearly freight bill of $250,000,000 which could better be used for growing timber than for transporting it.

There is no easy road out of this unprofitable situation. The end of free timber is in sight. World competition for the world supply will leave no large dependable source of imports open to us. The use of substitutes hardly keeps pace with new uses for wood; there is no likelihood that we can become a woodless nation even if we wanted to. When the free timber is gone we must grow our wood from the soil like any other crop.

Strange as it may seem, the American people, bred for many generations to forest life, drawing no small measure of their wealth from the forest, have not yet acquired the sense of timber as a crop. These immense stretches of cut-over land, mostly too rough or too sterile for tilling, have not awakened us to their vast potential worth as growers of wood. Fully one-fourth of our land area ought to be kept in forest—not poor, dwindling thickets of scrub, but forests of trees fit for bridges and houses and ships. Handled by the best timber-cropping methods, our present forest lands could be made to grow even more timber each year than we now use. But much of our cut-over land, lying idle or half productive, is now an immeasurable loss. It pays little or no taxes; it keeps few hands busy; it turns few wheels; it builds no roads. Idle forest land has scrapped schools, factories, railroads, and towns; it has dotted the land with abandoned farms; it has created a migratory population. Our forest problem is a land problem of the first magnitude.

It is likewise an industrial problem of great importance. These great industries that depend on the forest for their raw material—industries that, taken together, rank about third in value of output among our chief industrial groups—must be preserved. They employ a very large number of wage earners; they represent an immense investment of capital; around them are built whole cities; they feed the railroads with a vast flow of traffic. In the long run they depend for their existence on making our forest soils grow timber and on using that timber without waste.

This brief sketch of the forest problem would be incomplete if it did not mention the hopeful progress already made toward a better forest policy. Of our total forest area of 470 million acres, about one-fifth is in public ownership. Most of these

public forests are safeguarded from fire and dedicated to timber growing. Of private forest lands—in extent much the most important part of our forests—a little more than half have more or less adequate protection against fire. On the rest fire is free to ravage the young growth and subject the forest to a steady deterioration; but the Clarke-McNary law, passed by the last session of Congress, will I hope speedily change the outlook for these neglected forests. It authorizes Congress, in cooperation with the States, to establish systems of protection against fire; and it authorizes, among other things, cooperation in tree planting and a study to develop stable and equitable forest taxation. Very considerable progress has been made under previous legislation in joint fire protection.

Under the Weeks Law the Federal Government has purchased about 2 million acres of forest land in the Eastern States, as the nucleus of a national forest system for the East. Congress has wisely provided for forest experiment stations in 6 of our 10 or 12 principal forest regions, stations that are destined to become centers of knowledge and guidance toward better forest practice. Much valuable work has been done by various Government agencies in combating forest insects and diseases, and in research in many phases of better utilization of timber.

Among private agencies also there has been promising activity. Associations of timber owners in many regions have established fire protection. Here and there private owners have embarked on timber growing as a profitable investment, and the industries dependent on our forests are taking a keener interest in working out a forest policy. Forestry associations, State forestry departments, and forest schools are lending invaluable aid to the forestry movement.

There are hopeful signs. Yet we have started too late and are moving too slowly to bridge the gap between cut and growth. We must adjust ourselves to an era of reduced per capita consumption. We must husband our supplies. Granted that we shall get into effect a big-scale program of timber growing, it would be poor business to go to the expense of growing timber if we should persist in losing a large part of the crop by unsatisfactory ways of manufacturing and using it. Between cutting the timber in the woods and finally putting the product to use, nearly two-thirds of the total volume is lost. A third of this loss, it is estimated, can under present economic conditions and with tried and tested methods be saved—a yearly saving nearly as great as all the timber our forests grow each year. Saving timber, it is obvious, will not only reduce the amount we must grow, but if started now on an effective scale it will relieve the timber shortage and make less drastic the social and economic readjustments this shortage will force upon us. A tree saved is a tree grown.

In the coming struggle for timber, economic survival among the forest industries will depend on economic fitness. Economic fitness will be measured by good management and good technical processes. These qualities come from research and from training; and the forest industries, to reach a high level of skill, must make a full use of both these tools of modern industrial progress. Hitherto the diversity, the geographical isolation, and the small average size of our wood-using industries, coupled with abundance of raw material, have kept them from advancing as rapidly in improved methods as some of our more highly concentrated industries. But timber shortage will force competition in better methods. Much is already known of better methods, and the time is already here when this knowledge can be profitably employed. Many companies have, in fact, made notable progress in waste reduction and are furnishing examples of what can be done by careful management and expert planning. It seems possible that the individual industries, by banding together, can overcome their handicaps of isolation and collectively employ more experts to work out better processes.

It is to consider joint efforts toward better forest utilization that this conference has been summoned. It is a movement in which the State and National Governments, the industries, the universities, the consumers, and the technical experts should join. The various Government agencies equipped to help will, I know, be eager to do what they can to forward this undertaking. So vast an enterprise as the forest-using industries must not be allowed to decline for lack of raw material. We have abundant soil to produce it. We have the energy and the intelligence to learn to use our forests without waste. This conference ought to lay the foundation of a far-reaching and effective effort for forest thrift.

We hold the resources of our country as a trust. They ought to be used for the benefit of the present generation, but they ought neither to be wasted nor destroyed. The generations to come also have a vested interest in them. They ought to be administered for the benefit of the public. No monopoly should be permitted which would result in profiteering, nor, on the other hand, should they be indiscriminately bestowed upon those who will unwisely permit them to be dissipated. These great national resources must be administered for the general welfare of all the people, both for the present and for the future. There must be both use and restoration. The chief purpose of this conference is to discover policies which will, in the hands of private individuals and of public officers, tend to the further advancement of this already well-defined and securely adopted principle.

THE PURPOSE OF THE CONFERENCE

By HOWARD M. GORE

Secretary of Agriculture

Let me first express, on behalf of the Department of Agriculture, our sincere gratification that there has been so hearty and cordial response to the call for this conference. It shows, on the part of the delegates who have sacrificed their personal affairs to come here, a generous willingness to serve a public cause. Your presence gives recognition to the fact that a concerted effort is needed to conserve our timber and that joint action to that end is feasible.

Secretary Wallace gave a great deal of thought and energy to developing a national program of forestry. It fitted into his broad vision of conserving and handing down unimpaired to posterity our great heritage of natural resources, of maintaining the fertility of our farm lands, of saving our grazing lands from deterioration, of making our forest lands truly productive, and of saving our wonderful variety and abundance of wild life. He conceived of timber growing as a great and important part of agriculture, involving the wise and productive use of one-fourth of our whole land area. He looked forward to the time when all this great area would be redeemed from idleness and used for growing successive timber crops as our farm lands grow successive farm crops. He saw productive forests, not only as a vital adjunct to diversified farms, but as essential to maintaining the forest industries and the forest communities.

To the end that our forest soils might perpetually yield timber products, the department has been building up through research a mass of knowledge on timber growing and timber utilization just as earlier it began building up knowledge on growing, storing, marketing, and using food crops. The purpose now of the Department of Agriculture is to more effectively translate this valuable information that we have acquired by research and observation into a highly necessary and beneficial public service. The Clarke-McNary law, which embodies some of the important parts of Secretary Wallace's policy, lays the foundation for better fire protection on all our forest lands—certainly, I think everyone will agree, the first step toward better forest handling. It is a step that demands joint action by the Federal and State Governments and private timberland owners to work out successfully; and by the support which has already been accorded to the Clarke-McNary law by the various interests the department has been most gratified.

This conference represents another important step in the department's forest policy. In inviting the members of this conference to Washington, Secretary Wallace had in mind a fresh and combined attack by all the agencies primarily interested on the problem of conserving our existing supply of timber through more efficient methods of utilization. Such an understanding logically fits into the rounded program of forest conservation which he sought to develop. The purpose of this conference supplements the program of timber growing and timber protection by recognizing in timber saving an enormous potential addition to our supply of forest-grown materials in terms of economic service. Drawn from many diverse groups and occupations, the members of this conference have at the present moment a single united interest—the interest of timber saving. As I see it, the purpose of this meeting is to perpetuate and give practical expression to that unity of

interest. How can this purpose be put into effect in the woods and mills and shops where timber is manufactured, in the markets where it is bought and sold, and in the structures and commodities where it is used?

At the Forest Products Laboratory of the Forest Service, in the Bureau of Chemistry, and in the Bureau of Plant Industry, the Department of Agriculture has conducted a great deal of research in the better utilization of timber. This research has uncovered large preventable losses, aggregating between one-third and one-fourth of the present total drain upon our forests. It has developed many methods of reducing or eliminating these losses.

The department wants to see more of this knowledge put into everyday use. It is knowledge of the sort that will not only repay the public but will repay the user. Our belief that this knowledge can be profitably used is strengthened by the notable progress in the utilization of timber already made by individual companies, examples of which you will hear during this meeting from men who have been conspicuously successful in turning wastes to profits. Our task is to broadcast and accelerate that progress, rather than simply to prove that progress is possible; to get known economies into general use, quite as much as to devise economies not yet known.

It might well be asked why, if better methods are feasible, they are not automatically adopted as a matter of competitive improvement of business practice. We of the Department of Agriculture have been asked that question hundreds of times in a hundred fields of agricultural activity. We have learned the answer through long years of experience, and the answer always includes one or more of the following reasons:

Inertia of trade practice, and persistence of established customs.

Necessity for new training of operatives.

Necessity for new investments in plant or equipment.

Necessity for closer executive supervision.

Necessity for standardizing specifications.

Necessity for reorganizing and educating markets.

The department has again and again encountered or devised improved methods capable of paying dividends on all the costs involved, but still failing of widespread adoption for many years, simply for lack of an organized effort to overcome such obstacles.

It would appear that the effectiveness of this conference lies in organized industrial effort. The forest industries, in general, have not developed large concentrated units. They are of relatively small average size. In the primary lumber industries alone (including logging camps, sawmills, veneer mills, planing mills, and box factories) there are 38,000 establishments, as compared, for example, with a total of 6,000 textile mills, 2,700 chemical plants, and 2,800 automobile factories. In addition there is an enormous number of wood-fabricating plants, paper mills, chemical plants utilizing wood, and other industries.

Multiplicity and isolation make extremely difficult the problem of reaching all these diverse groups, as well as the great multitude of large consumers of their products, and force the conclusion that joint effort alone offers a solution.

The Government can not undertake by itself the task of reaching all these industries. The primary duty of the Government in forwarding this movement is through forest products research. Putting research findings into practice I regard as primarily an industrial function. In putting them into practice, of course, the Department of Agriculture, and other Government agencies, will be glad to offer such facilities as their means permit. But first and foremost we look to the Government to carry forward a program of research that will keep pace with the needs of better utilization.

On the other hand, we believe that the application of better methods of utilizing timber by all these industries and consumers is good business. We believe these better methods will pay their own way and that the time is ripe for the industries to undertake a broad program of education and training among its operatives and executives as a means of assuring future raw materials and of perpetuating the forest industries and vast economic interests dependent upon them.

REMARKS BY SECRETARY OF COMMERCE HERBERT HOOVER

It gives me a great deal of pleasure to join with the President and the Secretary of Agriculture in expressing the appreciation which we all have for the effort which brings the representatives of great industry to Washington in constructive public service. The Department of Agriculture has given fine support to the Department of Commerce in its efforts to establish better business practices and the elimination of waste in the wood-using industries. The conferences held by the Department of Commerce for these purposes have already proved the earnestness and devotion of our industries in such service.

My own view has always been that these great objectives can be best promoted by the Government in research work and in cooperation with the industries themselves rather than by regulation. I am in hopes that we may be of service to you in the development of the programs before you.

I conceive that industry has a great responsibility before it in the matters which the President has set out so ably. That is your purpose and it is in that spirit that you have assembled. Thank you.

INDUSTRIAL COOPERATION

By J. WALTER DRAKE
Assistant Secretary of Commerce

The introduction of Secretary Gore moves me deeply because of my very sympathetic relations with him and by reason of the splendid example of citizenship which he has brought into leadership as head of this department through the untimely death of Secretary Wallace. I feel that there is perhaps little for me to contribute following the statements of the two great leaders of American thought and action who have been introduced by Secretary Gore—the President of the United States, and my distinguished chief, whom you know from his relations to industrial activities; and I certainly can add nothing to the fine presentation of principles so aptly expressed by Secretary Gore.

One thought comes to me that I wish to express, however, before proceeding further. It is brought out by that word "cooperation" used by Secretary Gore. The American people, including ourselves, had apparently gone waste mad in the 50 years preceding the Great War. If you will go back to the time of 1850 and compare the per capita consumption and production of commodities in this country to those of the present day, you will see that it has been increased many times, even out of proportion to the ratio of increase of our population. During that period we have had applied the first basic necessity for all commerce, that which is behind all development of political, governmental, and economic activity; that is to say, the development of modern transportation. Without that we should not be living on the scale we enjoy in America to-day; neither should we have the production in America and consumed by American citizens of several times per capita of 75 years ago.

In that growth, however, not only of production but in productivity, and in arriving at that standard of living, we have developed habits of tremendous extravagance. There are holes all along the line of manufacture and distribution through which hundreds of millions of dollars have leaked out. This has been true of the use of our forest products; of wood and the utilization of wood; it has been true to a large extent of all our natural resources. The sun has been drying up here for thousands of years these millions of tons of water, and while science has advanced so that we reclaim the heat in applied energy, yet billions of dollars of power have been lost. I might give numerous other illustrations. Secretary Hoover saw what must be done for the millions of our people—that was to point out to the leaders, and through them to all others in industry, that before they proceeded in other directions to the improvement of manufacture, the opening of new trade channels, or to the preservation of outlets for their goods at home and abroad, they must take account of the extravagance and waste that permeated the whole economic system, and provide corrective measures. This was the conception, and I say it as a mere fact and not with any desire to be personal, of a great student of economics and a

leader of men, and it was what was needed in economic affairs of this country following the Great War. Reconstruction was the problem that faced the country, and Secretary Hoover conceived that the first step was to get a grip upon the imagination and minds of our people, of the industrialists, those who were producing goods and employing labor, and point out to them that these leaks must be stopped. The wastes of to-day are the profits of to-morrow; and if we would have those profits, there was no time to be lost in preventing the waste. To this end it was necessary to bring our industrialists to see that they must govern themselves through self-restraint and through co-operation. During the years since the Great War the American public has come into a full realization of the interdependencies of Government and industry.

The vital character of that relation was one of the outstanding lessons of the war, and in the period following the war there has been a splendid disposition on the part of the industrial leaders of our country to follow the path of development of understanding, helpfulness, and sympathy among all branches of American industry. The current problems of the Nation are largely economic, and their solution is found not so much in legislation but in sound cooperation and a full recognition of that interdependence. There is a new spirit and a new attitude in the Government to-day toward industry; and when I speak of industry I mean all branches of productivity—manufactures, mining, agriculture, forestry. That new spirit and attitude, if followed out to its logical conclusion, will help the lumber industry and all its branches; it will help forestry and agriculture and mining because all of these have a definite relation to and interest in forestry and the manufacture of wood products. We may well look upon the Government as an ally in the efforts of industry to solve the problems involved in a better utilization of forest products.

We are discussing here to-day the use of a basic material. Even the great adaptability of iron and steel through the achievements of science has not brought us to a point where there is now, or in the future will be, the elimination of the use of a vast amount of wood. There are two branches to this problem of utilization of wood—a dual problem. The Department of Agriculture is the custodian of a great natural resource in the national forests. The American public has long been aroused to the danger to our sources of supply of wood. Great strides have been taken to preserve and conserve the supply, and the Department of Agriculture as an executive branch of the Government is the national guardian of the forests. It is essential that in order to take measures to safeguard the supply of wood, both in the national forests and in private hands, all of the facts should be determined by thorough investigations and established upon a careful survey and with wise deliberation. This logically follows the conservation brought into play upon raising the danger signal against destruction of the forests. It becomes necessary after ascertaining the facts to put into effect such measures as will adequately conserve the resources of wood in the forests so as not only to provide a steady supply for the current needs of industry but as well to satisfy the future requirements. That is the first phase of the dual problem.

The second lies in the utilization of the wood from the time the log comes out of the forest down to its ultimate use in the hands of the consumer. That problem is for those engaged in the manufacture of wood products. It was to that end that the Department of Commerce in exercising its function of promoting trade, industry, and commerce of the United States undertook in conjunction with the lumber industry to ascertain the facts and devise means of correcting the abuses exposed by such a survey in the manufacture and distribution of wood products.

As has been true in other American industries, the manufacturers of wood products have suffered from habits of carelessness, waste, and extravagance that have resulted in tremendous loss to the industry and to the public. During the past three and a half years, the Department of Commerce, in the discharge of its functions, has directed its attention to the elimination of wastes of that description and has carried on extensive programs with the aid of industry which have already resulted in saving vast sums to the American people. Those savings have been reflected in every stage of industrial production and activity, in lessened cost and higher quality of products. In carrying out this purpose the Department of Commerce has sought the counsels and suggestions of the industries concerned as to what means might best be resorted to in correcting the evils. Many of you

men in this room have had an intimate part in that work, and indeed it is through your leadership and public spirit and your foresight that it has been made successful.

Against the background we have set up here to-day of the national forests and the privately owned forests, this meeting will be able to throw the reflection of the results of those efforts up to this time and to forecast what should be done in the future in carrying out the program of elimination of waste and utilization of forest products. There is, therefore, before you men here assembled, representative of the American public, an enterprise in which the two executive departments of the Government have a common interest, each in pursuing the work it has undertaken to carry on and each in bringing about such a correlation as will effectively serve the public, represented by both the Government and yourselves.

It will be instructive to point out briefly some of the activities in the Department of Commerce which are of course most familiar to me in this line of endeavor. Within that department, the Bureau of Standards, one of the world's greatest industrial research laboratories, has carried on extensive investigations affecting building materials. Through the Division of Simplified Practice, of which Doctor Gries, who will address you later, is chief, reports on home ownership, home building, and many specific related subjects have been prepared as a result of careful and extensive investigations, all of which have been of great benefit to the lumber and allied industries. One of the most interesting at this time under way is in the possibility of greater use of short lengths in construction. The results of all these surveys are available from time to time and are only one of the numerous contributions in the aid of industry in its program of economy of labor and materials.

In the Division of Simplified Practice of the Department of Commerce a program of elimination of waste and simplification in the wood-using industries has been carried on with the assistance and cooperation of the industry. There has been much accomplished in eliminating avoidable wastes by more scientific cutting, felling, handling, transporting, sawing, drying, etc. Much more remains to be done in connection with the avoidable wastes and work is being carried on in many directions with the full and efficient functioning of the wood products industries.

Another example of the satisfactory results of the endeavor of the Department of Commerce to aid industry is shown in the establishment of standards. For many years the industry lacked definite standards for sizes, thicknesses, nomenclature, etc. While some groups had standards of their own, others had different standards, but none of a national character. During the past two years the Department of Commerce, through this cooperative effort with the manufacturers, distributors, and consumers of lumber has brought about the development of standard sizes and dimensions. In this the assistance of the Department of Agriculture, notably the Forest Service and its Forest Products Laboratory, have been exceedingly helpful and constructive. Many semipublic organizations actively interested in lumber have also largely contributed to the success of the effort. As a result there has been a saving to industry and to the public in this waste-eliminating effort that is conservatively estimated at tens of millions per year.

These savings have gone into the pockets of those engaged in manufacturing, distribution, and marketing, but the larger part has gone into the pockets of the consuming public; cheaper and better quality have resulted, and that is what we are aiming to accomplish. If we can benefit the industry in this manner, the consumer will likewise profit greatly.

It is most fortunate that this conference brings together such a large number of men who have been engaged in the program of elimination of waste in the industry as I have briefly outlined it in the Department of Commerce. In that work, as I have stated, there has been a cordial cooperation of the Forest Service and its Forest Products Laboratory. The Department of Commerce is, above all, desirous of having the assistance of all concerned in this great problem in the continuance of those efforts, and it is particularly desirous of establishing a broader basis for fostering and continuing the extremely helpful relations with the Department of Agriculture to that end.

THE PROBLEM OF TIMBER WASTE

By WILLIAM B. GREELEY
Chief of the United States Forest Service

A large waste of raw, partly fabricated, and finished forest products in the United States is a recognized fact. We don't need to argue about its precise dimensions. Neither is it profitable to attempt any exact analysis of how much of this waste is preventable and how much is not; or to mete out the responsibility for poor use of timber to the logger, the manufacturer, the distributor, or the consumer. It is a common problem, resulting broadly from the abundance of cheap timber in the United States. It is a problem for which we are all responsible and in whose solution we all should share. The important questions are: Where do the largest losses in the use of timber occur? What can be done to reduce them? Who is going to undertake the job?

From the standpoint of the American public, the elimination of waste has an obvious bearing upon extending the life of our existing stocks of timber and hence upon all of the social and economic benefits derived from an adequate supply of forest products. The United States is not the first country to face a timber shortage. Western Europe had one and pulled through. Asia Minor and China each have had one and failed to pull through. Saving in the utilization of our timber was recognized as a vital part of forest conservation when we began to ask whether our future path should follow that of China and Asia Minor or that of western Europe. Research in forest products began in the Department of Agriculture in 1889. In the trinity of forest conservation which has guided our public activities and policies up to the present moment, the most efficient use of the existing supply of timber stands on an equality with the protection of forest resources and the growing of new crops of wood.

The industrial approach to the utilization of timber necessarily is a somewhat different one. Here the question becomes one of creating more raw material for a particular plant or industry, of protecting investments and established trade, or of finding new sources of profit. In the field of consumption, the problem becomes one of lengthening the life of railroads, buildings, and other structures where wood is employed, of reducing the cost of maintenance and replacements, and of finding fresh forms of raw material or more economical ways of using raw material. The difference between the public view point and the industrial viewpoint is no other than that which exists in practically every development having to do with natural resources or national economy. It is a difference in viewpoint only, as between the direct interests of the individual and the broader interests of the Nation. The fundamental possibilities of benefit are the same, and the mutuality of interest is so great as readily to afford a basis for joint effort.

It is worth pointing out that the United States is the first country where the exhaustion of timber in one section could be readily met by the cutting of forests 2,000 miles distant. Our transportation system has largely concealed the ultimate outcome of the exhaustion of old-growth timber. Because of our transportation system, we have practically pooled all of the old-growth stumpage in the United State and maintained our enormous use of forest products with no other ill effect, from the standpoint of current consumption, than constantly higher freight bills. From many standpoints this is a national blessing. On the other hand, it is dangerous because it permits practically a nation-wide depletion of high-quality timber before any very serious local effects, in any part of the country, may be experienced. In other words, we are in danger of coming up short, almost overnight, against a depletion of virgin timber so serious as to cause disastrous public and industrial consequences.

The point I would emphasize is that this marvelous tool of transportation, which has been such a large factor in meeting national requirements, ought to be employed with equal effectiveness in carrying out the economies now forced upon us. Our transportation system ought to make a local surplus of waste timber or inferior woods nationally available to the markets where they can be profitably utilized. Transportation ought to make it possible for local mill or woods waste to reach the plants and markets for box material, pulp, and fiber products, small dimension stock, and the like. An official of an important New England railroad recently proposed that

low grades of lumber be given lower freight rates in order that the railways may get the benefit of the traffic. If this proposition is sound from the standpoint of the railroad, it is doubly sound from the standpoint of timber conservation. I have never been convinced that the principle of lower tariffs for low-grade lumber or the waste products of a particular group of industries, enabling such materials to reach the points where they can be used, could not be much more widely applied in the United States.

Without attempting a comprehensive analysis of timber wastes, it may facilitate the proceedings of the conference to indicate where some of the greatest wastes occur. Decay in standing timber, in stored logs, pulpwood, wood pulp, and lumber, and of such products as structural lumber, railroad ties, pole and mine timbers while in service constitute one of the greatest drains upon the timber resources of the United States. Much of this loss is unavoidable. On the other hand, preventable decay probably destroys enough wood annually in the United States to build a city for a million people. The enormous quantity of wood exposed to decay in forms of construction where durability is a prime factor makes the loss of wood in service particularly serious because to the cost of the material has been added the cost of transportation, fabrication, and construction. Losses from this source can be largely curtailed.

Just as one of a thousand illustrations, let me cite some of the temporary buildings erected in the National Capital to house Government offices during the war. Within four years the floors of many of them had begun to sag. An investigation disclosed that for lack of ventilation much of the floor construction and parts of the lower walls had been consumed by the fungus commonly known as dry rot. This entire set of buildings had to be refloored in 1921 and 1922. This instance is typical of an immense amount of construction that is done under circumstances where there is not only time to provide ventilation or to use preservative methods, but where the cost of maintenance and replacement would be greatly reduced by such methods.

On a number of national forests in the central Rocky Mountain region the lodgepole pine timber is now being cut extensively for railroad cross ties. The ties cost about $1 each delivered at the railroad. In some instances they are given a zinc chloride treatment at a cost of about 20 cents per tie, which lengthens the serviceable life from 6 years to 13 years, an increase of over 100 per cent. Excluding interest items and installation costs, the cost per tie per year of service is thus roughly 10 cents for the treated tie as against 17 cents for the untreated tie, aside from the fact that the treatment proportionately prolongs the local sources of ties available to the transcontinental railroads. Yet quantities of untreated ties are still being put into permanent railroad tracks in this region.

Estimates indicate that the pulp and paper industry in this country must now absorb into its cost of production not less than $6,000,000 annually, lost through the decay of stored pulp and pulpwood, a loss which could largely be prevented at a comparatively slight outlay for better methods of storage, or simple treatments with fungicides.

Probably the fundamental reasons why such losses are not prevented up to the full limit of their economic feasibility are: First, that the financial control of the industry or of the construction job does not know what that economic limit is and may not be inclined to listen to the engineer who does know; and, second, because a showing of low construction or operating cost or quick results are more attractive to the management than slower work or larger initial outlay notwithstanding the earnings which they would gain in the ultimate profit of the business or in the ultimate durability and reduced upkeep of the structure upon which the business depends.

The solution of this particular problem would seem to lie in educating the manager's office so that not only will its attitude toward the best engineering practice be receptive but that the best engineering practice will be demanded. And in attacking the great, nation-wide loss from the decay of timber, we should not overlook the millions of small individual users of wood. At a time when the country is particularly concerned with enabling the farmer to reduce his operating costs and balance his budget, it is important that the great losses from decay in fencing and wooden structures on the farms be cured through educational measures.

Some one has pictured the seemingly preventable waste in logging which now occurs annually as corded wood extending a staggering distance, I

believe something like three times across the American continent. This is probably the most difficult waste problem in the entire gamut of our forest industries, difficult because of market limitations on low-grade material, because of the risks which surround new plant investments necessary for utilizing such wastes, and because of the uncertainty of what is economically convertible into some form of commodity that will pay returns. On the other hand, there are notable examples where aggressive merchandising has removed market prejudices against little-known or supposedly inferior timbers, and where new products or by-products have been successfully developed from material that formerly was burned up in the slash fires.

I believe that large possibilities for industrial benefit lie in the diversification of wood-using industries. Owing to the original abundance of our virgin forests, it has been characteristic of forest industries in the United States that each has cut its own path into its own particular patch of old-growth stumpage, utilized what it could, and discarded the balance. Hence high-grade virgin stumpage has gone and is still going indiscriminately into lumber, matches, box shooks, pulp and paper, railroad ties, mechanical distillation, bobbins, clothespins, and 57 other varieties of forest products. At the opposite extreme stand such forms of correlation as have been attained in Sweden, where an annual product of about 3,000,000 tons of pulp and paper is manufactured almost wholly from logging and sawmill waste. The development of forest industries in America during the last 10 or 15 years has brought out notable examples of the same type of correlation in using timber, with a group of factories making varied products taking the place of a single plant or group of plants manufacturing but a single product. Where this type of industrial development has come about, the problem of utilizing logging and mill waste disappears.

The balance type of forest exploitation ought, whenever it is economically sound, to displace the single-product factory or the single-product mill town. But the physical proximity of a series of plants designed to make use of everything "except the squeal" is not necessarily the only form which this industrial evolution may take. To refer again to transportation, it seems to me reasonable that the economic system which now carries Douglas fir lumber from Washington to Maine can, in some way, move much of the low-grade material and inferior lumber species now abandoned in West Coast and southern logging to some plant or market where they can be used. Our transportation system ought to play a more effective part in bridging the gaps which now separate useful material from specialized plants or specialized markets.

The preventable waste in sawmills and other manufacturing establishments also piles up an enormous yearly aggregate, a large part of which ought to find productive utilization at some point in our demands for wood. Much of what I have suggested for the utilization of logging waste, through the diversification of forest industries, applies equally to the utilization of mill waste. There are, however, several other developments which offer more immediate application.

Let me cite the instance of a hardwood mill at Memphis which could not move No. 3 common oak at $9 per thousand feet. This plant finally secured an order from a refrigerator company for small dimension stock at $75 per thousand feet. It took 4,000 feet of the No. 3 common to make 1,000 feet of dimension, and the converting cost was $14. A clear profit of over $6 per thousand on the original material was secured, utilizing what had previously been unmovable stuff. If this plant had been equipped to convert mill waste as well as low-grade boards into dimension, the yield would have been much higher and the profit greater.

The refabricating plants in this country still largely buy boards of standard dimension and resaw them to suit the purposes of the particular factory, resulting in a material waste of raw material on which both the manufacturer's price and freight have been paid. At the same time, back in the sawmill, much mill waste which could yield small cut stock still goes unused.

The same principle holds in the utilization of lumber of short and odd lengths, which merges into the dimension stock problem, on the one hand, and into the standardization of lumber grades, on the other.

The broad principle of adapting primary manufacture to the actual requirements of the refabricating plant or consumer, with mutual savings all along the line, has a wide range of possible applications. There are obstacles in its way. Probably

foremost stand the lack of mutually adjusted specifications and the need for education alike of the producer and consumer. Hence the mills continue to burn up small pieces and to cut boards into even lengths while the manufacturer resaws the boards or the builder cuts them down to fit his blue prints. The inertia of trade practices and customs will have to be overcome. That they can be overcome is proved by the recent notable progress made in standardizing lumber grades and specifications, a striking example of the possibilities of coordinate industrial action.

In many ways the dimension stock problem is a test case. To "put over" the dimension stock idea is admittedly difficult. No great headway can be made, in my judgment, until the trade associations and other organized industrial groups set about to make the dimension stock proposition a going commercial practice, provided for through careful study and specifications and with a mutual give and take in sharing the economies and profits derivable from them.

Let us suppose, for example, that one of the hardwood associations was to start negotiations with one of the furniture associations which buys its boards. Assume that the furniture makers determine the amount, kind, size, and grade of the cuttings which they use, or, in other words, make up a bill of materials. This can be done, because the Forest Service has actually tried it. Let us then assume that the hardwood sawmills determine by actual trial the amount, kind, size, and grade of the cuttings they can obtain from their low grades and mill waste; and that this bill is compared with the furniture manufacturer's bill. This, too, can be done. The hardwood grading committee has recently completed a very similar job.

Let us then suppose that both associations set up a joint service agency to work out the remaining obstacles that are bound to crop up, establishing a common language for placing and filling orders, and obtaining from the Government any research that may be needed in seasoning problems, allowances for dressing, and the like. I am confident that within a practicable period, and at a practicable cost, a new and mutually advantageous method of supplying the furniture industry with its raw material could be put into operation.

A survey of the Forest Service indicates that while 4 feet is the minimum length recognized by the hardwood lumber grading rules, 73 per cent of the material needed by the furniture and similar wood-using industries is in lengths of 4 feet and under. And 58 per cent of their material requirements is in widths of 4 inches and less. Is there any serious question that such a process of getting together can be worked out to mutual advantage? And this of course simply illustrates the sort of mutual coordination on the basis of common benefit that is applicable to a large range of problems.

Wastes in air seasoning or kiln-drying of lumber are difficult to estimate, but appear to be nearly as great as the preventable waste in logging. Large quantities of both hardwood and softwood lumber are deteriorated or actually discarded because of staining, checking, warping, loosening of knots, and other seasoning defects. Apparently over 4 per cent of the present total drain upon our forests occurs through losses of this character.

Seasoning losses have the advantage of being largely susceptible to direct attack at the individual plant; and this can usually be done without large increases in the plant investment. Losses from this source, in other words, are in a different category from those which require either by-product factories or a correlation of specifications between different groups of manufacturers. They are largely under the control of the individual lumber producer.

For example, a Louisiana sawmill which manufacturers red gum lumber until recently reported an annual loss from blue stain amounting to $40,000. During the past year all of the sap lumber at this plant was treated with live steam as soon as it left the saw. The company now reports that the loss from blue stain has been entirely avoided and that their red gum lumber commands a premium because of its bright condition.

The difficulties in preventing losses from seasoning center largely around the need for a more technical handling of stock and kilns and more skillful supervision. An important obstacle, in other words, is the difficulty in obtaining in everyday yard and kiln practice the proper use of carefully adjusted technical processes, as distinguished from the old, easy rules of thumb. This undoubtedly is the reason why many sawmills suffer a degrade in one-fourth of their output when better kiln-drying would limit the degrade to one-tenth. But that is

not a reason that ought to survive the test of competition. If this is a correct assumption, it occurs to me that an ample incentive exists for trade associations to push the adoption of less wasteful processes and to offer their members expert technical service in this particular field.

I have offered simply a few examples of the nature and causes of the waste of timber in the United States. A complete enumeration of them would cover the whole gamut of forest-using and wood-fabricating industries, together with practically every phase of wood consumption. Many of them will be discussed by following speakers. The important question that concerns us to-day is, who is going to reduce the waste of our timber supplies, and how are we to get about it?

My own view of forest conservation is that of an evolution in industrial operations and in the use of land, brought about primarily by economic forces. The pressure of competition and the commercial incentives which it creates will, as timber becomes more scarce and more valuable, gradually remove many of these losses. It is already doing so. The huge waste burner, so typical of the American sawmill, is beginning to disappear from our industrial landscape.

But the nature of the problem is such that individual competition works under a tremendous handicap and will gain ground in waste prevention but slowly. Our whole timber-manufacturing and wood-using business is so largely the creature of customary specifications, trade practices, the inherited traditions of employees, the structure of freight rates, and similar set conditions, that the opportunity for individual competitive effort is greatly restricted. We pride ourselves, and with reason, on the creative genius of American industry. The problem of saving timber waste in the big way that is demanded can not be solved without a large dose of that same genius.

As I view it, a joint effort should be directed, utilizing all of the agencies available: First, to extend research in the utilization of timber on a much larger scale, in order that we may continue to ferret out the better methods and more economical processes that undoubtedly await the quest of the trained investigator. In the second place, we should so organize that every promising research project carried through the laboratory stage can promptly be given a commercial test under operating conditions. In the third place, we should provide for educational work in a large way to "put across" among the manufacturers, refabricators, distributors, and consumers the results that have been proved to have practical merit. And, finally, we should attack the great problem of so correlating the operations of different industries and of so correlating industrial developments with consumption that the whole enterprise can be carried through from start to finish.

In the last analysis, of course, the commercial incentive of more profitable business will be the driving power behind this whole movement. But much can and must be done through organized effort to speed up the momentum of that power. Just as in the growing of timber, the country is now seeking through a drive upon forest fires and forest taxation, to give freer play to the commercial interest in reforestation, so in this field should coordinated effort seek to give freer play to the business incentive for the better utilization of our timber supply.

And I want to reiterate that a sharp difference exists between this problem and the more usual economic problems that can be left to the automatic adjustments of supply and demand. There is no practicable solution of our timber situation outside of what we do right here in America. We should not delude ourselves with the notion that either importations from abroad or substitute materials at home are going to fill the bill without very serious losses to American industries and American people. The public concern in this situation is manifest. Its concern to forest industry, although from a different angle, is nevertheless equally great. Neither can we afford to ignore the fact that only joint effort will meet the situation.

The Federal Government, the States, universities, and research organizations should enlist in this campaign, horse, foot, and dragoons. Their help can doubtless be rendered most effectively through the investigation of timber utilization problems, particularly the types of investigation that dig deep into fundamental science and may require a number of years before results capable of direct application can be secured. They should help as well through surveys of facts, technical advice, educational support, and whatever by way of teaching to carry known betterments over into the business their facilities

may permit. This, in itself, is a very large order.

Nor should public agencies by any means monopolize the field of research in timber use. Many American industries have been leaders in research. There is every reason why our forest industries should, in their own behalf, take an active part in this phase of timber utilization, as a number of them have already done.

Any expansion in the efforts of public agencies will have but small effect except as it supplements what the forest industries and forest consumers of the country themselves undertake. Forest products research is like a voice crying in the wilderness unless some form of industrial organization is ready to take what it offers, try it out under commercial conditions, and then disseminate it through the trade. Personally, I would draw no hard and fast lines on where Government activities should stop in putting the results of research into practice through various forms of trade demonstration and education. I would go just as far in this direction as our resources will permit. But I am reminded of the retort made by a very keen Member of Congress, upon a request for appropriations for this purpose, who asked why it was necessary for the Federal Government to legislate brains into the forest industries of the country.

Whatever public agencies may be able to do in this direction, I believe that getting betterments into practice through commercial demonstration and trade education must be assumed largely by the industries themselves. And this to-day is the crux of the problem. If what we already know could forthwith be universally applied, a tremendous gain in the consreva-tion of our timber resources would be immediately effected. And the more we find out, the broader the horizon of research becomes, equally more important will it be that effective agencies exist for the prompt application of investigation results.

The fine response to the call for this confernece issued by Secretary Wallace indicates that the forest industries and wood users of the United States are keenly alive to these questions. You have assembled here for a practical and definite purpose. The general facts as to our timber situation are thoroughly known to you. We have passed the stage of generalities and theoretical discussion. What we are here for is a plan of action. I trust that out of his conference will be evolved a program of specific jobs that should be undertaken in order to drive most directly upon the particular forms of timber waste which will most readily yield to organized effort. And as I view it, we need to plan also, for some permanent, well-financed agency that will act as a clearing house or steering committee, to guide the movement as a whole and bring together the particular industrial representatives, through project committees, or otherwise, who should deal with any given situation. If these two things can be done by the conference, it will stand as a milestone in forest conservation.

WASTE IN INDUSTRY AND METHODS OF COMBATING IT

By C. H. MacDOWELL
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The individual, organization, or State holding or devoloping a natural resource should in the public interest be charged with the responsibility of proper administration. Natural resources, broadly, are of two classes: Those which when used are exhausted, such as coal, and those which can be reproduced in whole or in part, such as timber.

Waste in industry has two broad phases: Waste of material resources and waste of human effort.

Efficiency begins in the home; so does waste. The home attitude toward work and industry vitally influences the individual during his working years. Man is naturally wasteful, especially with common property. "Easy come, easy go," is based on fact. Work is the real measure of value.

Workers vary in ability, capacity, judgment, thrift, ambitions, attitudes, age, and health; and their industry is controlled by these factors as well as by opportunity. So it is with collective effort exerted in corporate form. Efficiency fluctuates from time to time in men and in associations.

In the earlier days of our industries we were favored with a large supply of raw materials easily procured and cheaply transported. Fuel was plentiful and widely distributed. The great shortage was labor, and necessity

forced an unusual development of labor-saving machinery. The recovery yield was secondary. Competition in some lines also had its effect on extraction yields. In European manufacturing countries where raw materials were not so abundant and where labor was plentiful, the trend was toward a more complete utilization of raw materials. The European early made greater use of chemical research than we of America—our genius ran more to engineering as better solving our problems. To-day we are making large use of an unusually competent staff of research and executive scientists.

In recent years the chemist and metallurgist in this country have made progress even beyond that of their European fellows. Our utilization of low-grade ore bodies and recovery of dilute wastes is not excelled in any country.

In the development of industry much avoidable wasts has been permitted, although it must be accepted that no large enterprise can be brought to successful operation without some weste. Our problem is to minimize it.

Man labors and produces. Both labor and production vary in accord with the amount of head and back put into the task. A large part of production carries final costs for to-day and to-morrow above what should prevail if we put more vision, science, research, and human understanding back of the problem.

The larger part of delivered cost on commodities is accumulative labor cost, which is not to be confused with direct labor cost. In the lumber industry, from stumpage to the delivered wholesale price, 79 per cent is paid labor in some form or another. Coal figures are about the same; railroad labor, 81.8 per cent; steel, 85 per cent; agriculture, 75 per cent, including butter, fruits, soil crops; all figured on the delivered wholesale price at distributive markets.

There is a theoretical waste—not extracting the most that might be produced from a given material if complete utilization were effected. To do this of course is not always practical. What might be wasteful practice in one section would be unwise in another where plant, labor, and transportation costs to possible markets would show a loss. It is good practice to recover as sulphuric acid the sulphur fumes from the zinc and copper smelters of the mid West, East, and South where the acid can find a ready outlet. It would be unwise to recover the fumes in the Rocky Mountain sections, as delivered cost at point of consumption would be prohibitive.

In many mining operations a point is reached in recovery beyond which it is not good practice to venture, as costs would be excessive and above competitive asking. If these decisions are made by competent engineers and carried out by able superintendents, we of to-day can not justly find fault. It is the avoidable waste—the waste which comes from incompetent handling, from inadequate equipment, from technical ignorance, and above all from greedy exploitation of the cream for the profit of the day at the expense of the future—that we can properly criticize, and take steps to remedy.

One of the most important surveys of waste in industry was that made by a committee of the Federated American Engineering Societies. This report covers intensive study of the following industries: building industry; men's ready-made clothing manufacturing; boot and shoe manufacturing; printing; metal trades; textile manufacturing; along the general lines of "Sources and cause of waste" and "Recommedations for the elimination of waste," as applied to the above businesses. General chapters on unemployment, strikes and lockouts, accidents and health, purchasing and sales policies, as they are applied to the problem in question, are also included. It is a most able summary of the situation.

Agriculture is fundamental. Waste on the farm is basic. Feeding grain to scrub animals with resulting low weight gains or low milk production is pure loss, as compared to feeding animals of maximum possibilities. Overproduction of special perishable crops in restricted areas causes untold losses. Potatoes in Maine to-day are bringing the grower but 75 cents per barrel—far less than the cost to grow. Undoubtedly some potatoes will not be dug. Others will freeze in unheated storage. Again waste, productive effort expended on unproductive acres, low yields due to lack of appreciation of proper tillage and fertility. And again, transportation cross hauls and long mileage due to lack of crop diversification are examples of our agricultural shortcomings.

One of the first industries to attract attention to waste conservation was the livestock industry as it ramified into the modern packing plant. There soon developed the principle of mak-

ing the most of raw materials and carrying them to end products while they were in hand.

By-product utilization has at times been forced on industry by the necessity of reducing or eliminating risk or nuisance elements.

Thrifty, shrewd, bifocal, sharp pencil management has in certain instances given itself orders to develop the most out of its raw materials before competition or restrictions forced such developments, and this has generally resulted in steady growth and increased profits. The attitude of management toward waste elimination, and the research necessary to minimize it, often spells the difference between indifferent and splendid success. Self-styled "practical men," through general distrust of the "expert" and his work, frequently retard their own advancement. To be sure, there are "experts" and experts.

We will not venture to discuss forest products waste, another phase of our agricultural problem; that is, a province most ably covered by the specialists of this convention.

Fuel—that is, coal and oil primarily—gives us a most glaring example of the present-day tendency to waste our resources and opportunities. Inefficient boiler-room practice causes perhaps the greatest waste of coal in industry. In one branch—the railroads—fuel efficiency campaigns have shown 5, 10, even 15 per cent saved in locomotive firing. Our railways consume $550,000,000 worth of coal annually.

In mining, the amount of coal left in the mines under present competitive conditions runs from 10 to 50 per cent of the total tonnage. Use of coal strata and pillars for overhead protection in place of artificial supports is common practice. Removal of penalties for the production of fines by the miner has resulted in the raising of the percentage of screenings in Illinois mine run coal from 19.6 to 48 per cent.

Over the past 30 years our coal mines were idle an average of 99 days per year. In few cases are coal mines operated more than one shift, as is common in other mining industries. Installation of power drills and other mechanical devices in the industry is opposed by the miner; costs would be lowered and production increased by their use.

By the long-wall method of mining as practiced in Europe under government regulation, nearly 100 per cent of the coal is recovered. Similar methods, together with the use of concrete and steel supports, will produce corresponding recoveries in our mines. Present-day competition, together with the absence of Government regulation, prevents such practice now.

Freight cross hauls are most important in coal distribution, as well as in many other industries. West Virginia coal is hauled to Kansas and the Dakotas—Colorado coal to Illinois and Iowa—Illinois coal to Nebraska.

Duplication of selling effort is enormous. Forty producers have 40 salesmen covering a territory whose total requirements could be easily supplied by any three companies.

During the four years 1920–1923 approximately 179,000,000 tons of coke were produced in this country. Fifty-two and a half million tons of this, or about 30 per cent (requiring eighty-seven and a half million tons of coal) were produced in the old-style beehive ovens. These save no by-products. Had this eighty-seven and a half million tons of coal been coked in modern by-product ovens, an additional 10 per cent, or eight and three-quarter million tons of coke, over beehive recoveries, would have resulted. Twenty-six pounds per ton, or 1,139,289 tons, of sulphate of ammonia would have been produced. Proportionate quantities of gas, tar, and benzol would have been recovered. A total money value of over $382,000,000, or over $95,000,000 a year, was wasted. Modern developments in low-temperature carbonization and in destructive distillation, giving more and better gas and increased tar and sulphate of ammonia recovery, together with utilization of this gas for boiler firing in a new type of boiler of unusual efficiency, promise far greater economies than even present improved practice.

Improvement in design and capacity of modern electric power producing units has resulted in greatly increased efficiencies. To-day's central power station produces electrical energy at only one-third of the fuel consumption of the small units in use 20 years back. A careful survey of the city of Chicago alone shows a possible conservation of 3,000,000 tons of coal per annum, if all present small power-producing units were discontinued and all electric power produced in large centralized stations. Further economies in labor, supplies, and capital overhead would also result.

Large economies have been made by the reduction in varieties of products manufactured in this country. For

instance, there were 66 different sizes of vitrified paving brick being manufactured. After three revision conferences with manufacturers, this number was reduced to 5, which fills all needs. Like reductions were made in hundreds of other articles.

Great loss to capital and labor accrues from restrictions on trade cooperation in mining and manufacturing, resulting in overproduction, followed by shutdowns, liquidation, and unemployment.

Mishandling of machinery, improper lubrication, poor material used in construction, scrapping of parts which might be economically repaired, all cause unnecessary losses.

Distribution costs are excessive—inferior type of personnel—square pegs in round holes; too many salesmen; unnecessary traveling; "beating the bushes" for small orders; useless telephoning and wiring; needless and long-winded letters; too great an extension of the credit system with increased accounting, collecting, and bad-debt liability.

Fire kills 15,000 Americans a year and destroys more than $500,000,000 worth of property. This is an average of $4.50 per capita. The average per capita fire loss in Great Britain, France, Italy, Germany, and other European countries is less than $1. Our traditional carelessness, types of construction, and lack of personal liability for negligence are the main contributing factors to the enormous losses in this country.

How much of this is preventable is problematical; certainly a large proportion. Better electrical and heating installations and insulation; better plant sanitation and inspection; better types of construction; better design in hazardous occupations; all these will go far toward removing this unnecessary menace to production.

The public building fire loss (schools, churches, hospitals, hotels, and theaters) for the first 10 months of 1924 was $26,280,000. In this figure no loss of less than $10,000 is included.

The traffic accidents in this country last year were responsible for 22,600 deaths, injured 678,000 people in addition, and caused over $600,000,000 property damage.

The owner and worker jointly may do much to conserve our natural resources and to prevent waste. The human machine is our greatest asset. When it is in prime condition there is a minimum of waste. When it is crippled in any measure there is certain to be a larger waste both of energy and material. The amount of waste everywhere depends mostly on the health and normality of the human machine. For this reason, medical departments in our industries should be equipped to function efficiently.

Preventable disease exacts a heavy toll from industry. The Surgeon General estimates the cost of such diseases to be $3,000,000,000 a year, and half a million human lives. This entails loss of production, loss of wages, medical services, and other direct outlays; all reflected to a more or less degree in excess cost, or, in other words, industrial waste.

Labor disputes, strikes, and lockouts cause large losses, much of which could be avoided if we understood each other's problems better and indulged in greater mutual respect.

In doing away with some of the waste in industry it is necessary to study the make-up of the materials handled and ascertain their extreme possibilities in manufacturing and distribution. This can be done in the private research laboratory through the industry maintaining research facilities jointly or in cooperation with Government and State research laboratories. Much work has already been done and a great deal of data are at hand, if we will only make use of them. Some of us may be in the frame of mind of the farmer who wouldn't subscribe to an agricultural paper on the plea "I haint afarmin' now half as well as I knows how."

The examples of waste mentioned are typical of all branches of industry and all lines of human endeavor. The human element enters into the problem in the most vital way. The entire personnel must be educated to the fine points of the question involved. Executives must be made to realize the necessity for the conservation of our material resources. Superintendents and operation directors must be made to recognize the necessity of carefully following the plans and outlines of technical specialists. The mechanic and laborer must be made to see the cost of wasted endeavor, whether it be in spoiled material or in useless labor. Only by having all thoroughly appreciate, as far as they are able, the relationship of each step in production to the final cost of the end product, can the facts be driven home. Disinterest and indifference may represent an actual loss of 25 per cent in direct labor.

Aside from any material results for present generations, a debt is owing

to posterity. Granting that new thought will devise new methods, it yet is our duty to preserve for future generations all possible natural resources. Intensive education of all classes in the fundamentals of these principles is necessary to achieve results.

Some one has written, "To make men do good things willingly even when they are not easy to do * * *." To create and maintain interest on the part of the worker whether he wears overalls or a white collar; to increase craftmanship technique; to reduce as far as possible the monotony of repetition work; to ascertain the viewpoints, ambitions, and capabilities of the workers, young and old; to encourage suggestions; to reward for improvements; to compensate by genuine friendliness, by promotion for ability, as well as by money pay; to be fair and square; to not "nag"—these are some of the duties of management if they want their colleagues "to do good things willingly even when they are not easy to do."

To the worker, "one must give to receive"—and the giving comes first. We individually pay for our holdout on work. A poor barber has few customers.

THE ROAD TO BETTER UTILIZATION

By JOHN W. BLODGETT

Chairman, Central Committee on Lumber Standards

The Secretary asked me to speak briefly on the subject of how to correlate the forces or agencies which must be used in bringing about the closer utilization of our forests. Having little definite knowledge of the methods and processes of making wood pulp and its products, I naturally approach the subject from the standpoint of the conversion of the tree into lumber, and the ultimate uses thereof. From their nature, wood, pulp and its products invite much closer utilization of wood than does lumber and, therefore, the solution of that part of the problem should be much simpler.

The subject assigned to me for discussion is somewhat complicated. There is a nation-wide distribution of lumber producing and consuming plants, with a variety of processes and products, using many different species of wood, and whose products find their way to an almost endless variety of uses. However, if we can ascertain the nature of the disease, we then know what kind of a doctor to summon on the case.

In converting the tree into lumber and placing the product in the hands of the ultimate user, there are five general agencies involved. these are: (*a*) logging; (*b*) sawmilling; (*c*) retailing ; (*d*) wood specification by architect and engineer; (*e*) conversion into form for final use.

Wood waste, be it unavoidable or otherwise, must chiefly be chargeable to one or more of these five.

In considering the facts in each of thsee processes, we have time to take up only the chief causes for failure of better utilization, and to suggest the method for finding and applying the remedy.

Let us first consider the process of logging. Is there a waste in this? The answer must be undeniably, yes. What, then, causes this waste? The answer is clear—the chief root of the trouble is the handicap imposed by the economic conditions surrounding the lumber industry. In the Pacific Northwest, for example, where this waste is greatest, over 60 per cent of the sawmill product is to-day sold below the cost of production. Clearly, the sawmill man can not live, industrially speaking, on any lower grade of logs, and without a market the logger can not cut his timber any closer. We all know that with the enormous expense involved in building logging railroads and buying equipment the logger will naturally take from the forest every board foot which he can sell at a margin over the cost of production and of stumpage. Indeed, he is quite apt to go too far in this direction and accumulate a stock of unsalable cull logs. The fundamental difficulty, therefore, that prevents better utilization on the part of the logger is, as I have stated, economic.

There may be, and probably are, other loopholes for waste, but we know that all over this country the leading logging operators are meeting, freely interchanging experiences, and finding ways to reduce logging costs—a result that leads directly to closer and better utilization of the forest.

Next, what about the sawmill? Is there waste in this process? Again

the answer must be yes, sawdust. What, then, is the cause, or causes, that lead to waste in this case? As with the logger, the chief trouble is economic. In lumber, as in most stable lines of manufacture, the productive capacity is much greater than our normal consumptive capacity. It must also be noted that lumber manufacturing differs greatly from most manufacturing industries in that the lumberman must provide in advance many years' supply of his raw material, with a correspondingly greater burden of investment. The pressure of these large carrying charges, and of constantly increasing taxes, especially on timberlands, is a persistent urge toward continuous lumber production, with little or no reference to actual consumptive needs. The result is a vicious circle of rapidly fluctuating prices, attended by a fluctuating degree of forest utilization. "Uncle Sam" helps to aggravate this situation by promoting still greater production through sales of forest reserve timber when the consuming public is already full supplied. This procedure does not result in any benefit to the consumer. The thousands of mills cutting from privately owned forests are sufficient to insure him the lowest possible prices. It should be said, however, that these timber sales are mainly due to causes largely beyond the control of the executive branch of the Government. Permit me, however, to here suggest that sound public policy is opposed to the conversion of publicly owned timber except to save an over-ripe forest or to supply a real public need for lumber. Both Federal and State statutes make impossible any action in the direction of making the supply correspond with the actual demand. Even if the laws permitted complete freedom of action, there would be small possibility of bringing about any such condition because of the widely scattered nature of the sawmill industry and the thousands of sawmill units involved. However, this situation demands some consideration.

Again, trade practices of to-day do not permit the saving that might accrue from the use of odd lengths and odd widths, and the use of short lengths occurring in ordinary manufacturing process has never been considered from a utilization standpoint. The latter in fact serves chiefly as a source of irritation and dispute between manufacturer and retailer. Distance from consuming markets is naturally one of the leading factors controlling forest utilization. It is probable that only further refinement and scientific research can aid in modifying this handicap. It can never be completely removed.

In the sawmill then we find waste due to economic conditions, caused by the inherent peculiarities of the industry, by excessive productive capacity, by lack of scientific knowledge, by poor trade practices, and by adverse laws. It must also be admitted that what President Coolidge recently said of the farmer applies with equal force to the lumber manufacturer—too much concentration on the economy of production, and too little on good merchandising. Good merchandising, as a rule, means good utilization. In the Vermont vernacular, both interests have been "saving at the spigot and wasting at the bunghole."

We now come to the retail branch. I touch lightly on this part of our industry for fear of reprisals. The retailer should have a general knowledge of the products of the sawmill and should be of great assistance in finding outlets for material now wholly or in part wasted. Conservation can not function until there is a market for the materials sought to be conserved. For such service the retailer should and would be compensated. He has the contact with the consumer, and knows how to best supply the real needs. All this demands close cooperation between the retailer and the manufacturer.

The retailer will advise you that he also has a loss or shrinkage in the process of his merchandising that reaches considerable proportions.

Next we come to the architect and engineer. Here we have a most important factor in the matter of reducing wood waste. The ultimate consumer buys lumber of the dimension, species, and grade prescribed by the technical adviser. Are these prescriptions based on the information necessary to make for the best utilization, and hence for ultimate economy? Waste in lumber is an unsound economically as waste in steel, cement, brick, wall board, or any other building material. The difficulty has been, and is, that those who make wood specifications have been instructed only in the inherent qualities of different wood, and have not been advised as to the supply of the various species of timber and the product of the manufacture thereof.

We now come to the precess of conversion into form for final use. Obviously this includes building construc-

tion as well as the myriad of factories using wood as a part or all of their raw material. We all know there is some waste in most all these cases. Two or three years' supply of kindling wood is left over from the construction of the ordinary frame dwelling, and many wood-using factories everywhere are selling the same material. This can hardly be called waste, but it certainly is poor utilization of a carefully refined product.

We find, then, only partial utilization all along the line. The logger leaves a very considerable portion of the tree in the woods, and the subsequent processes do not consume all of that part which he does deliver. Can this condition be improved? The answer is surely in the affirmative. The lumber-producing industry has made slow but steady strides toward better methods and closer utilization. Markets have been developed for material that until recently was absolute waste. The adoption of the slab resaw, of improved dry kilns, and of more efficient logging machinery are later examples of mechanical progress; and I am sure the wood-using industries generally are accomplishing similarly good results. Standardization of lumber grades and sizes, now well under way, is a direct and splendid move toward better utilization.

Our problem to-day, however, is how to get still better results and how to get them as quickly as possible. How can this be accomplished, and through what agency or agencies? To say that the industries themselves must adopt the suggested changes does not answer the question. There must be established leadership.

We have a widely differing though related group of industries involved, and obviously only a careful scientific survey of the processes and practices of each one will disclose the waste and the way to possible remedies. Such surveys might and undoubtedly would find that the waste of one industry is suitable raw material for another. Might and probably would disclose the existence of some waste material for which only further scientific research could find a practical use. Might discover the right substitute for time-worn wasteful trade practices which should have long since been discarded. Might discover economic barriers which only Congress or the States can remove. Obviously, these surveys should be conducted by a single agency. It must be an agency that commands public confidence, because the task also involves the education of the public. It must, therefore, be an instrument created and supported by the public itself. It must be an agency which can correlate the facts as disclosed by the surveys and suggest to the industries how these can be utilized. Beyond all, it must be an agency wholly impartial and interested only in ascertaining the true situation. Such an agency, fortunately for this Nation, is now in existence. I have in mind the Forest Service and its Forest Products Laboratory. The time has come for the Department of Agriculture to enlarge the scope and activity of the Forest Service. With the aid of the Clarke-McNary bill, together with its long forestry experience, the bureau is now well on the way toward tree protection and reproduction. Now it should be equipped to make an equally intensive study of this other essential branch of real forest conservation.

The first task of the industries here represented is to aid in getting Congress to recognize the magnitude and importance of the undertaking. When the survey is under way, and with the usual cooperation of the splendid organization of the Department of Commerce, good results will surely follow.

Our duty toward the Nation will then be to adopt every suggested measure of wood conservation that economic and legal conditions permit. To this service I am sure every industry involved will pledge and will give its active cooperation.

UTILIZATION OF LITTLE-USED SPECIES

By H. OLDENBURG

Weyerhaeuser Lumber Co.

I have been requested to tell the story of Cloquet's utilization of little-used species, illustrating how the grouping of diversified industries adjacent to a continuous timber supply not only has made it possible profitably to use hitherto little-used species such as jack pine, but makes for a permanent forest community.

Cloquet has been a lumber-manufacturing center for half a century. During all that time its leaders have

filled an honorable place among the empire builders of the Northwest. Why I should have been asked to tell you of their work I am at a loss to understand, because I have labored with them at Cloquet, in preparation for this 15-minute talk, only about 40 years.

Until the fall of 1918 the experience of Cloquet in timber utilization was much like that of other lumbering towns in the Lake States. Originally only large, well-developed trees were cut. Then only such part as would make clear lumber. With changes in economic conditions, and increased prices of stumpage and lumber, utilization in the woods became closer. For many years only white pine was logged, then Norway, and finally jack pine and other species large enough for log timber. Further utilization followed as these industries came in turn, a ground-wood and print-paper mill, sulphite mill, box factory, and toothpick factory. The number of large sawmills had increased to five, with an annual output of about 250,000,000 feet. Around these industries a city of 10,000 people had grown.

In the fall of 1918 it seemed that the end of Cloquet as a large lumbering center was near. The Cloquet Lumber Co. and the Johnson-Wentworth Co., owning and operating three of the mills, had a remaining timber supply of only two years. The Northern Lumber Co. had an estimated supply for eight years. With the closing of these mills would go in large measure the source of supplies for the other wood-using industries.

On the night of October 12, 1918, came the terrible forest conflagration that wiped out the entire residence and business sections of the city, all its schools but one, and all its churches and public buildings, the entire mill plants and yards of the Northern Lumber Co., the planing mill and a large part of the lumber of the Cloquet Lumber Co. The 10,000 inhabitants fled, leaving all their personal belongings to be burned. Only the wise action of Mr. Fauley, local agent of the Great Northern and Northern Pacific Railroads, in holding trains and putting into service every kind of car, prevented a great loss of life. In the neighboring regions there was a loss of some 300 lives. R. M. Weyerhaeuser, president and manager of the Northern Lumber Co.; H. C. Hornby, president and manager of the Cloquet Lumber Co., and his office manager, Mr. H. G. Stevens; Mr. Wilson, manager of the Johnson-Wentworth Co., with his mill foreman, A. McKale, and a lew helpers, but not enough to operate the fire equipments, remained and faced the dangers of that night, and did much to prevent a greater loss of industries.

The destruction was so complete that it can not be imagined. The heat was so intense that everything burnable was completely destroyed, and the hurricane of fire carried burning embers and ashes miles away. Witnessing the conflagration, it seemed as though the very gates of hell had prevailed against Cloquet and that the place that knew her should know her no more forever.

It was hardly believable that her people should come back, but they did. The early confusion was great. The railroad station and all traffic-handling facilities were destroyed, and the first quick shipment of relief—provisions and materials—added to the congestion and confusion.

The managers, with their masterly skill, worked wonders in hastily constructing camps and shelter for their men. The greatest blow fell upon the women and their families. All household furnishings, clothing, and provisions were destroyed. This calamity came on the threshold of a Minnesota winter and with it an epidemic of "flu." Mrs. R. M. Weyerhaeuser sensed the situation and quickly organized relief work and met this first sore need, and served under those trying conditions at the risk of her life, as only the white-robbed soul of womanhood can, in the spirit of the Master. Other women quickly rallied to her support, and Cloquet will forever remain indebted to the sacrifice, courage, and vision of her women through this trying ordeal.

This glimpse of Cloquet's background is necessary to catch the deep significance of her new birth to forestry.

The officers and stockholders of the lumber companies were deeply touched by this return of their old employees, and resolved to do everything in their power to give them employment and lengthen the life of their industries. What followed had its inception in this impulse, and has been a sort of evolution.

Some of the stockholders are not sure which way this evolution is going. With all due deference to Mr. Bryan, they see in it much that looks painfully like monkey business. More than two million of their dollars have been absorbed in experiments and more must follow. Everywhere they

can see red. But they are not quitters, and we may profitably consider what they are doing.

Northern Minnesota has literally millions of acres that are better adapted to growing timber than to agriculture. It grows the valuable white and Norway pine and spruce. Also, in great abundance, what the Secretary has called "little-used species" and what with us has been termed "weed woods," the rapid-growing aspen, birch, and jack pine. While our growing season is short, these species grow naturally and constantly, and if fires are kept out, and all of them profitably used and waste eliminated, the number and variety of our timber-using industries could be multiplied many times and continue to serve humanity as long as the world endures.

It is said that adversity does not kill, but we have it on divine authority that "where there is no vision the people perish." Cloquet's vision is that this complete, profitable, and perpetual utilization of all our woods can be accomplished.

It would be a privilege if I could speak to you again at the end of the next 40 years. Not that I could hope to prepare another 15-minute speech in that limited time, but experience makes me hopeful that I might then correct many of the mistakes in this one.

Our lumber mills have been restored to a capacity of 150,000,000 feet per year. The box factory of Rathborne, Hair & Ridgeway Co. uses 20,000,000 feet annually of short material in its daily output of about 7,000 boxes. The toothpick factory of Berst-Forster, Dixfield Co. is using annually 2,000,000 feet of white birch logs in its daily output of 62,000,000 toothpicks, 250,000 tongue depressors, 500,000 throat swabs, and 400,000 clothespins. The paper mill of the Northwest Paper Co. had been manufacturing from spruce and balsam about 60 tons of print paper per day. This mill has been entirely reconstructed and enlarged so as to use 100,000 cords per year of our little-used species, aspen, birch, jack pine, and tamarack, in making book and wrapping papers. We are not yet producing standard stocks in commercial volume, but what has been accomplished gives assurance that the product of these "weed woods" will make the best book and wrapping papers manufactured.

The Wood Conversion Co. was primarily organized to utilize mill waste. It has developed the process of making balsam wool for insulating, sound-deadening, and other purposes from the screenings of the paper mill and mill waste, and will manufacture and sell this year about 7,000,000 feet. It has conducted extensive experiments and costly operations for the development of a synthetic board from mill waste. Other factories are using some of these products. For instance, the G. & W. Sash Co. is expanding into a large plant, and in part uses balsam wool and synthetic board in the construction of refrigerators. The Commercial Woodworking Co. is using mill waste for making paper roll plugs, paper frames, wire reels, and other specialties.

You will note that these developments are along three distinct lines: The manufacture and utilization of lumber and wood in an increasing variety of ways and down to the smallest pieces; the utilization of all the fiber woods in the making of paper and fiber products; the utilization of the sawdust, bark, and refuse from all of these processes. Thus we are utilizing everything but the whispering in the tree tops. These developments are by no means at an end, but will multiply and intensify wood utilization.

Large problems remain, such as increased fire protection, wise and right methods of taxation, and the adjustment of industries to our natural and well-balanced wood rations.

This brings out what the Secretary desired—the advantage of grouping diversified industries adjacent to a continuous timber supply. The principle is exemplified in Cloquet: That complete utilization is only possible when highly specialized mills cluster around the larger mills and utilize their waste. No one of these specialized mills could go into the woods for their raw material. The cost would be prohibitive.

This work has restored Cloquet. It is a city of beautiful homes, churches, schools, public buildings, parks, and successful business houses, and a profitable market for the surrounding farm and timber crops.

Cloquet can never fail to appreciate the inspiring and helpful cooperation of all the various Federal and State agriculture and forestry departments and their efficient corps of workers, of lumbermen and all Cloquet's coworkers, and acknowledges its deep obligation to the honored president of our national association, Frank G. Wisner, whose purposes are always noble and sincere, and whose tireless

work for its membership is always practical and efficient.

If Cloquet, with all this cooperation and inspiring helpfulness, can contribute one right sentence to America's primer of practical forestry, yet to be written, then will her dream come true, and she will be proud and happy indeed.

CLOSE UTILIZATION IN NEW ENGLAND

By RICHARD T. FISHER
Director of the Harvard Forest

My story is about a small corner of New England, and an old one, and I think it may gain its chief interest from the fact that this portion of Massachusetts and New Hampshire represents a definite second economic phase—a phase not yet reached elsewhere in the United States. So far as my remarks to-day apply to it, it is about 40 miles square and about 20 years old, economically and socially speaking. The first settlers came there in the first quarter of the eighteenth century, when the whole region was substantially forests. In the first 140 years they brought the forest area down to approximately 30 per cent; that is, they had nearly 70 per cent of the total land area under farms or grazing. After that, from then on until 1850, the agricultural element stood about still. Since 1850 the percentage of open land has been steadily falling, and natural reforestation following upon the abandonment of this open land has brought about exactly the reverse condition. To-day we have in that neighborhood about 70 per cent of our area in some sort of woodland and less than 30 per cent in farms. The first century was wholly agricultural, with no industry at all except small local water mills. The second century has wound up with a woodworking community. There are some 20 towns within 30 miles of where I live which are largely woodworking, and the main activity of those towns, stretching back into the timber, is supported very largely by wood. The point that is interesting to us, I think, as conservationists, is that all that very considerable investment and material prosperity is based upon timber that has grown since the Civil War.

To many of you here who come from regions, where timber is big, the pictures that you will see of these little New England trees will be laughable. But the test of the value of a tree is not its size, but how much value and utility it furnishes to the population. As I see this problem of conservation, it is double-barreled. Until we are able to utilize the tree with a return that will enable us to put some money back in the land, we can not have forestry. On the other hand, we can not have the tree unless we know how to take advantage of and maintain the permanent productivity of the forest.

The Harvard forest is a tract of about 2,000 acres. It is now producing approximately 400,000 feet annually of saw timber, and a good many hundred cords of wood, as many almost as we can find market for. But in all the 16 years the forest has been in operation, the thing that has been forced upon me over and over again is that we can not have more silviculture, we can not put more intensive treatment into the woods until we can find use for this or that unmerchantable species or waste product. So we have been constantly jumping from one end of the problem to the other.

As we found out more and more how to handle the forest as a crop, we were able to apply these improvements increasingly by virtue of an improving market for low grades, small sizes of stick, and less desirable species. To-day, broadly speaking, any kind of tree, either hardwood or softwood, that will saw a live edge board with a 4 to 6 inch face, is salable. Naturally, even with this kind of market, the completeness of utilization is limited by the cost of transportation. Nevertheless, the central New England region has actually reached a point where close utilization has made silviculture pay. Many thousand acres in the neighborhood of the Harvard forest are being productively and permanently managed. To a considerable extent this outcome has been due to a happy combination of economic factors. But whatever the cause, the consequence is that many communities in the region are potentially, if not actually, enjoying a permanent yield of wood with the stability of business that goes with it.

The following figures illustrate certain methods used on the Harvard

forest in securing the establishment and satisfactory growth of a new crop after the cutting of mature timber:

Figures 1 and 2 show the same area in the years 1911 and 1923, respectively. Figure 1 represents an even-aged stand of white pine 60 years old. A heavy thinning has been made for the purpose of admitting light to the forest floor so as to stimulate the germination of seed. In this operation both logs and limb wood could be profitably utilized, and the very small remainder of slash was burned. In the course of the ensuing six years abundent reproduction took place, amounting for much of the area to 30,000 seedlings per acre. In Figure 2 is shown the same area as it looked in 1923. The remainder of the original stand was cut in 1918. Since then the pine reproduction has recovered from the slight suppression due to shade from the old stand, and is now growing vigorously. These two views show the possibilities of bringing about reproduction through the so-called shelter-wood method.

In Figure 3 is illustrated a process of treatment ordinarily indispensable to the establishment of a satisfactory young crop. In many pine forests, where pine reproduction is usually lacking, there is already a more or less complete thicket of hardwood seedlings and saplings. This advance growth is sometimes desirable in itself, but always so vigorous that unless checked it will overtop and kill young pine seedlings, which may have originated at the time the old stand was cut. To correct this condition, whether to produce an adequate crop of pine or to make sure that the desirable species of hardwood will survive, it is necessary to weed or clean the young crop while still in its early stages, before the worthless elements have hopelessly suppressed the valuable. In Figure 3 such species as pop-

FIG. 1.—First stage (1911) of a shelterwood cutting in white pine in the Harvard forest

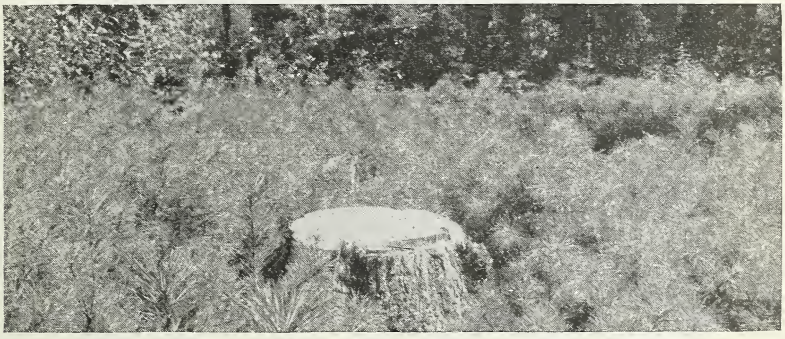

FIG. 2.—Final stage (1923) of shelterwood cutting—old timber all removed; complete natural reproduction of white pine

lar, red mable, and gray birch, and all too-rapidly growing stems are being cut back in order to set free white ash, red oak, and white pine.

FIG. 3.—Weeding the young forest. Poplar, red maple, and gray birch are cut out to set free white ash, red oak, and white pine

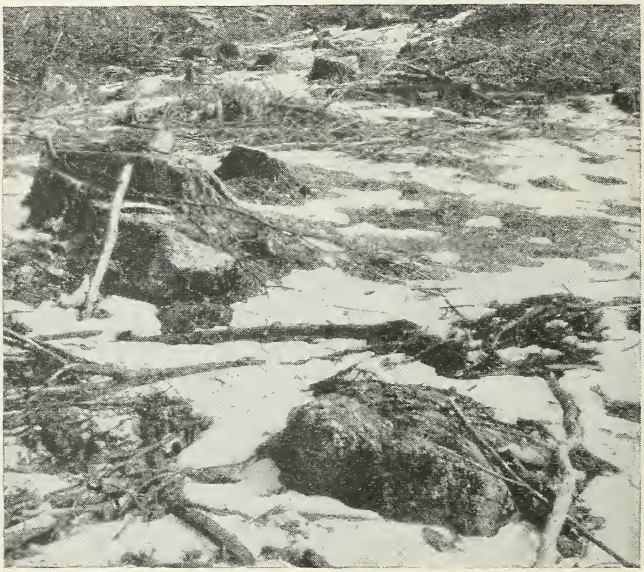

FIG. 4.—Part of Harvard forest cut over in 1909

In Figures 4 and 5 is shown what can be accomplished by making the best of such natural reproduction or advance growth as already exists in the forest. The two views apply to the same area, a tract originally covered by a stand of mixed pine and hardwood, approximately 65 years old. View 4 was taken in the winter of 1909, immediately after the clear cutting of the stand, and before the last of the slash was burned. The abundant reproduction of hardwood, not visible in the picture, was intentionally cut back to the ground during the logging. In Figure 5, a photograph

made in 1921, the new crop is finally established in satisfactory density and composition. Originally consisting of a great variety of hardwood species, both good and bad, it has been weeded or cleaned twice at a combined cost of less than $7 per acre. The result is a solid stand of white ash, hard maple, red oak, and paper birch already well pruned of side branches and promising a high grade of saw timber.

The operations shown in these pictures, although involving a slight increase in the cost of logging and a small investment in the new crop, have not prevented the realizing of a substantial profit over and above the charge for stumpage.

FIG. 5.—Same area as Figure 4, but 12 years later. After two weedings or clearings the tract has a complete stand of white ash, hard maple, red oak, and paper birch

CLOSE UTILIZATION AS A FACTOR IN PERMANENCY OF FOREST INDUSTRY

By A. C. GOODYEAR

President, Great Southern Lumber Co

There is perhaps no subject of public interest that has been more consistently misrepresented than that of forest utilization. The lumberman has been continually pictured as a tree butcher operating chiefly for the production of sawdust and fires, whether in the mill burner or the forest. In the past his standing in the eyes of the general public was about the same as that of the bootlegger of to-day. Under the attacks of what he has regarded as a lunatic fringe, the producer of lumber has generally, and perhaps wrongly, remained silent. To him it has seemed foolish to assume either that he was deliberately wasting resources upon which his industry was dependent, or that he could be expected in the process of manufacture to save anything that could not be saved profitably. Unopposed the muckraker has worked upon our public until the housewife, whose garbage can is richest in proteins, and her good man, whose factory is largely devoted to air pollution, are united in their horror of the man who cuts down trees.

At the same time, the very men who have been most vociferous in their condemnation of the least waste of timber, have been most insistent, in their purchases, on getting none but the highest grade of lumber at a nominal price. They have insisted, too, that this lumber shall be of fixed widths and lengths, well calculated to produce waste. More recently, and I believe largely because of the same vision and quiet efficiency of the present Chief Forester of the United States, a change has come about in the public attitude. People are beginning to realize that complete utilization is possible, and indeed is de-

sirable only so far as it is profitable. The sawmill man of old, so far as the knowledge and market of his day would permit him, used his timber just as fully as it is used in the most modern operation, and the sawdust pile he left was a monument not to his inefficiency and heedlessness, but to his courage and enterprise in penetrating the wilderness and making its resources available for the great growth which this country has seen. Inevitably with the progress of time and the development of new uses for forest products, the unprofitable has become profitable, and just at the moment when our timber resources have been depleted to a point approaching the minimum necessary for our requirements, complete utilization is rapidly becoming generally possible, and under favorable conditions has, in my opinion, become an accomplished fact.

Forty or fifty years ago, in the hills of northern Pennsylvania, lumbering operations were on a large scale. The pines and the hemlocks and the hardwoods were being cut down and brought to the mills for manufacture. The logging operations left a tangle of tops and broken pieces on the ground which waited only for the fires which were nearly inevitable. At the mills the refuse burner was the hardest-working part of the plant. Here and there stood a struggling wood alcohol plant that used the inferior hardwoods, and at several places kindling wood factories worked up the softwood mill refuse that would otherwise have burned. But still there was a large amount of material left in the woods and the fires in the burners were hot. The waste could not be used profitably.

In 1890 there was built at Austin, Pa., a pulp and paper mill which, so far as I know, was the first mill in this country to use woods and sawmill refuse as its raw material. From the beginning of the operation of this plant, the burner of the Austin sawmill went on a starvation ration. Twenty years later, when a flood wiped out the town and a new sawmill was built some miles away, we did what no lumber operators in this country had done before, we built a mill without a burner and we kept it without a sawdust pile. The mill refuse was used in three ways, for making kindling wood, for making pulp, and for fuel, and that was all the mill refuse there was. In the forests the softwood refuse was gathered up and shipped to the pulp mill, the hardwood went to a stave factory, and the hardwood tops and broken pieces to wood alcohol factories; and that was nearly all the woods refuse there was.

A former Chief Forester of the United States, who has not always seen eye to eye with the lumbermen, wrote of this Norwich operation a year ago: "The utilization at Norwich was probably more complete than that of any other large lumbering operation in America." And yet, with this degree of utilization, the only effect on the permanency of the forest industry at this particular place was to increase the chances of reforestation by reason of the smaller amount of inflammable material left in the woods. We did not practice reforestation. Under the tax laws of the State of Pennsylvania, it was not possible to do so profitably, and in our lumbering operations it is not our intention to do anything that is not profitable. Complete utilization alone does not have any appreciable effect upon the permanency of forest industry.

About 1902 the owners of this Pennsylvania operation became the founders of the Great Southern Lumber Co. They acquired several hundred thousand acres of yellow-pine timberland and promptly proceeded with plans for the operation of their property. They believed in cutting down trees. They built the best sawmill that could be built at that time, and erected the largest refuse burner that could be bought. They had not forgotten Pennsylvania, but yellow pine refuse was full of rosin and rosin made a very hot fire. Furthermore, this sawmill was the largest sawmill in the world, and its refuse was as yet unprofitable.

We knew from experience that some day the refuse would be profitable, so we employed the best forest chemists available to make a careful study of the possibilities of the utilization of waste. Their report was a volume consisting of 811 pages, and proved too large for immediate digestion. It was a good report though, and we made a mistake in not following it more closely and more immediately than we did. Its major recommendation was that we should construct a mill for the manufacture of kraft pulp and paper. In 1917 we built a kraft pulp mill and a container or liner board mill. To this has been added during the past year a kraft paper mill. Since the pulp mill began operations in January, 1918, it has operated entirely on sawmill and woods'

refuse, and both pulp and paper mills have depended on sawdust for fuel.

About four months ago pulp production had been brought up to a volume that left the sawmill burner without fuel. It became obsolete overnight and has been left standing only for use in case of some disaster to the pulp mill, and as a monument to destruction. In the past 16 years that burner consumed daily over 500 cords of waste material, a total of nearly 3,000,000 cords. It cost $75,000, and it has consumed each year of its life several times its own value.

It was not the pulp and paper mill alone which made it possible to extinguish the fire in the burner forever. In the manufacture of broom handles, lath, shingles, staves, and box shooks we have worked up annually about 16,000,000 feet of material that must otherwise have been wasted, and in the production of light and heat for all the plants and for a town of 16,000 people, we burned 200,000 tons of sawdust and shavings annually. Through the operation of all these agencies together, sawmill waste at Bogalusa has been eliminated.

In the woods everything down to 3 inches in diameter is brought in for pulp wood, leaving only the small limbs and the pine knots. A large part of this small material remaining is used for engine fuel and charcoal. Passing through cut-over lands three years after the trees have been removed, when the young growth is beginning to show, there is no refuse to be seen. It may almost be said that in the woods, too, there is now practically no waste. The young trees that are left standing will grow to maturity, and as they grow, reseed the land. Two years before the trees are cut they are turpentined. As the lumber goes through the dry kilns, the turpentine is extracted by a steam process. As the pulp is manufactured, we will soon be extracting the turpentine from the wood chips. So far as present knowledge goes, we will then be saving everything there is to be saved.

What effect does all this have on the permanency of forest industry? That is the question that the Secretary of Agriculture has asked. I had not thought of it in that light before, and when I first began to consider what I should say in this paper, I was on the point of following the example of the writer on Ireland, who included a chapter on "Snakes," which consisted of one sentence, "There are no snakes in Ireland." As I have thought more, however, it has seemed to me that utilization will have a very real bearing on the permanency of forest industries. It is, of course, obvious that as there is a market for low-grade lumber, there will be more timber for the mills to cut and the lives of those mills will be longer. When we consider permanency for a single operation, however, we mean the establishment of industry in a fixed location on a basis that will mean continuous operation of the timber as a crop. In such an operation utilization is of the greatest importance to permanency.

First, we must utilize the young, thrifty trees. We must leave them standing, partly to profit by their growth, but primarily to replant the ground. They are unpaid workmen who will give us a new forest at a cost of less than 40 per cent of replanting by any other means. Then as the new growth comes on, it must be thinned to permit of a proper rate of increase and to pay for the thinning, the saplings cut out must be utilized—for charcoal first and then for pulp wood. As the trees mature, they must be bled for gum, and the turpentine and rosin will help bear the cost of maintaining the organization.

In 30 or 40 years, when the final cutting is made, the process will begin over again. None of us will see that beginning. We can not tell positively how it will all work out, but we are determined to give our descendants a chance to call us blessed if we are right. We can say quite certainly that utilization alone will not give permanency. With it must go reforestation, fire protection, and proper tax legislation. Utilization is just as essential as its three fellows; together they are the big four of the forest problem.

LOGGING AND MILL LOSSES IN THE PACIFIC COAST STATES

By R. W. VINNEDGE
President, North Bend Timber Co.

It is, indeed, heartening to our industry to behold the hand of our Government extended in friendly gesture. The lumber industry is conscious of the honor and privilege thus accorded by this great branch of

our Government, the Department of Agriculture, to gather here to-day for a discussion of the problem of preventable waste in our industry.

We court constructive criticism, realizing that the judgment of others, even though critical, broadens our perspective and makes for progress.

We entertain the hope that a frank portrayal of the conditions with respect to waste as they exist in our industry will make for a better understanding on the part of the public of the fundamentals of the problem.

I have been asked to speak on the subject of logging and mill losses in the Pacific Coast States. In the short time allotted to me to-day, I can not hope to treat with this subject in any but a superficial way. I shall relate, as I see them, some of the things we are doing that we should not do, and some of the things we are expected to do that are impossible of accomplishment, and give our reasons therefor.

The casual observer, beholding a logged-off land vista in the Pacific Northwest, will at once exclaim at the apparent lack of utilization.

It might be pertinent here to state that our virgin forests comprise the largest trees and the heaviest stands per acre to be found anywhere in the world, excepting possibly the redwoods. Our trees average 3 to 8 feet on the stump and from 180 to 250 feet in height; 40,000 to 100,000 feet per acre is a very common stand, with smaller hemlock and cedar intermingling in disproportionate volume percentages.

Our average logging "show" to-day is on rough and rugged ground, and the problem of felling these huge trees without considerable breakage is obvious. In such a stand breakage often runs as high as 20 and even 40 per cent in the more rugged "shows," but the average of 3 or 4 per cent is quite normal and what appears to us to be an irreducible minimum.

Nature has imposed many hardships upon the Pacific Northwest logger, in her seemingly inscrutable methods of growth. Leaning trees must be felled according to their "lean," and many times the most expert workmen can not avoid felling them across stumps and ravines, which are the natural enemies of utilization. This is one of the greatest contributing factors to the vista mentioned.

The problem here largely revolves around the fickle human equation, with which all employers of labor are struggling. There are all too few capable and conscientious fallers and buckers. A careless workman in this department can waste many times his wages in one tree and do it before he is apprehended. Close supervision is the only remedy.

In felling a 200-foot fir tree, the top log, receiving the greatest impact, obviously is the greatest sufferer, and being of the lowest value of the tree is the least susceptible of utilization in its broken and mangled condition. Also these logs in over-ripe stands of fir are usually defective by reason of stain and rot.

If a lake or pond were accessible to the logging railroad, it has seemed to me at times that some method might be employed, in reasonably level operations where the cost of logging would be low, to accumulate thereon at least a portion of this after-logging débris and manufacture it into lumber. I can not quite visualize the kind of sawmill this should be, because it would necessarily have to be sufficiently versatile to saw both large and small logs, and at a very low cost and with a minimum of handling, to produce it at a cost below the ever-fluctuating sales price of the obviously low-grade lumber. However, an operation of this character would not, over any extended period of the past, have been profitable for the latter reason. Intermittent operation of any industry or branch is not profitable, as any business man can testify. For the past year an operation of this character would not have returned the cost of gathering the logs, much less transportation, manufacturing, and overhead charges. Then, too, one must not overlook the disturbance to the major operation inevitable in the clean-up. Several projects of this character have been tried and to my knowledge none has survived, nor will they, in my judgment, until the realization factor is more stable.

In the early stages of our logging operations we were guilty of high stumps and a resulting needless waste of a good percentage of the highest grade lumber in the tree. Modern practices, however, frown upon high stumps and they are becoming very largely minimized.

In the "bucking" or sawing-into-log-lengths operation, after the tree is down, there is perhaps the greatest possibility for saving.

Careless measuring of logs for lengths and grade is prevalent. In many operations the bucker measures the trees into log lengths, using usually an 8-foot stick for the purpose.

The usual instructions to the bucker are to allow 4 or 5 inches over the even length log to provide for the "run" of the bucker's saw and for the kerf of the trim saws in the mill. Carelessness and indifference on the part of the bucker, aided and abetted by a lack of proper supervision and checking, result in millions of feet of waste each year in the woods. A "bull-bucker," or superintendent of fallers and buckers, is usually employed to supervise this department. In an average operation, however, this man can not, or at least does not, hold this waste to a minimum.

If the wood-consuming factors of our citizenship can be cured of the diabolical habit of demanding even-foot lengths of lumber, millions of dollars might be saved to society, which includes alike the man who uses and the man who furnishes the product of the trees.

Many thousands of dollars are lost each year by improper grading of bucker-marked logs. Our logs are graded 1, 2, and 3. No. 1 is a butt and/or second log, which when manufactured, will yield 50 per cent or better clear lumber and is differentiated from other grades by absence of knots, decay, and other defects prevalent in our timber; No. 2 logs must yield 25 per cent of clear lumber; No. 3's comprise the top logs suitable for manufacturing into common grades. It is manifest that intelligent grading of a tree is an important factor. A bucker is almost invariably not a grader and concerns himself more with matters pertaining to convenience of his work rather than with the factor of grades. Many of our operators are adopting this system of grading-scalers—one to each two sets of fallers and buckers—who use steel tapes for measuring. The favorable comparison of this method with the old is quite apparent, even to a novice. The grading-scaler method should be universally employed, and will, in my judgment, result in a great saving to be made in our woods to-day.

The necessity for felling the larger trees first may not at once be obvious. If one but witnesses one of these giants crashing to earth, carrying everything before it, he visualizes the effect upon the smaller trees interspersed among the stand. It is, indeed, the survival of the fittest. One asks, and with some pertinence, "Why are the smaller trees not logged first?" In a minimum of cases this might be done with horses—so far as topography is concerned—were it not for the fact that these smaller trees are usually hemlock, which command a low price, usually below the cost of production, and the dual system of logging will not at the present disparity between cost and sales price return a new dollar for an old one. However, the topography in our average "show" to-day renders the horse method impractical and there has been no mechanical method thus far evolved which permits of profitably logging the smaller trees through the larger ones. Our logging machinery is conceived along massive lines to haul logs from 5,000 to 8,000 feet in volume. This same equipment will not permit of profitably hauling the smaller logs. The giant *Leviathian* crossing the Atlantic with a quarter cargo would be a fair analogy.

An interesting experiment has recently been made by a paper concern on the Columbia River, which by means of small skidders has gathered the small hemlock trees remaining after the logging operations and converted them into pulp. The expense, however, equals the present cost of hemlock logs in the river, and apparently the relogging operation is possible only because of the close alliance between the logging and the pulp concerns and because of a minimum transportation charge on their own logging railroad. This relogging could not be done were the low-grade product secured to be sold in the open market.

At the present time, in my own logging operations, I am leaving in the woods many hundreds of hemlock logs 10 inches in diameter and less, to which roads have been built and upon which I have paid the felling, bucking, and overhead charges, but which I can not afford to haul to salt water because the delivery cost price is in the neighborhood of $17 per thousand and the current sales price $10 per thousand. Millions of feet of these and other low-grade logs have been and are now being left in the woods, for the reason I have mentioned above.

Waste this is, indeed, and deplorable. Yet the solution is an economic one, which I will discuss later on, and can not to-day be accomplished in the woods.

The inland mill logging its own timber can utilize more closely because it pays no freight to the transcontinental railroads. Yet 45 per cent of the lumber output of Oregon and Washington is manufactured from

logs produced by the so-called commercial logger, who has no sawmill and who pays from $1.50 to $4 per thousand freight to the transcontinentals, in addition to his intracompany transportation costs, which must be added to the production cost of the logs. The broken tops and the stained and conky logs produce only low-grade lumber, which sells at from $8 to $12 per thousand at the mill, and when manufactured by the average log-buying sawmill, whose average costs range from $18 to $22 per thousand, can only result in a loss which is patent.

Within the past few years a certain highly efficient sash and door operation in the Puget Sound district has successfully experimented with sawing a limited number of these logs, converting them into cut-up stock. This affords a limited market which is assisting the logger in partially reducing the amount of material he formerly left in the woods, yet this amount is very small, and the price paid for the logs is only $4 or $5 per thousand, which, while the limit of the mill's ability to pay, considering the waste involved, is, in the light of an average log production cost of $17 per thousand delivered in salt water, unprofitable to the logger; yet he is in this small measure contributing his part to utilization.

Many attempts have been made to convert after-logging waste into cordwood, but prohibitive freight rates have usually rendered them thoroughly unprofitable.

The fire hazard resulting from the débris left on the forest floor is very great, and in the past, and even at present, is responsible for serious fires, yet the efforts of the Washington Forest Fire Association, formed by the lumbermen and timber owners of the Pacific Northwest, have evolved systems of slash disposal, many of which are now incorporated in our State laws, and they are aiding most intelligently in reducing the fire losses. This association commands the admiration of all who have observed its operation.

Carelessness with slash is still prevalent, yet an intense and growing appreciation on the part of the logging operators of the fire menace is resulting each year in more intelligent cooperative methods.

Here, again, the public must be regulated. During the past season but 14½ per cent of the forest fires in our woods were chargeable in any way to the logging operations. Campers, berry pickers, careless smokers, farmers—in short, the pleasure-seeking, innocently careless public—must be educated and restrained.

I have been asked to mention the influence of improved machinery on utilization and to show whether or not we are abreast of the times in this respect. As an example, I cite the following comparison. I purchased my first logging engine 20 years ago. The price was $1,300 and the accessory equipment perhaps $250 more. Six months ago I installed a modern logging unit which cost, complete with accessories, $39,000. Measured by the dollar sign, at least, this reflects the degree of mechanical evolution. As to the wisdom of this investment, I can say that comparing the new machine, and the system built around it, with the one displaced, the investment, in my judgment, will be repaid within 12 months.

Sea level "shows" have disappeared. To-day our timber stands are on the steep sidehills and in ravines. Old methods could not apply in many instances were we to use them. Financial extinction confronts the operator who does not keep abreast of the modern trend in mechanics and methods.

As evidencing our interest in these matters, I cite the fact that for the past 15 years the Pacific Logging Congress, comprising five Northwestern States and British Columbia, has held annually four-day sessions, to which machinery and equipment manufacturers, foresters, and technical men are invited. During these sessions papers are read and informal discussions held upon every phase of logging problems, methods, machinery, organization, forestry, and fire prevention.

It is fitting here to mention the splendid cooperation we have received from our district representatives of the United States Forest Service, not only in these congress sessions but upon all occasions where they have been called upon to assist us.

It is a pleasure to record the high regard our industry holds for the Chief Forester, Col. William B. Greeley, which regard is merited by the practical and businesslike conduct of his department in our territory.

We maintain our alert and efficient intrastate logging associations, which compile composite cost statements and analyses, sales-statistics, inventories of stocks in the water, and other data necessary to intelligent conduct of our business.

As reasonably intelligent business men we realize the necessity for removing everything possible from the land, for when we arrive at the spar trees to begin the operation of hauling logs, 65 per cent of the total logging cost has been expended and any increased volume removed at that stage of the operation reduces the costs. Obviously we remove everything possible of sale at a profit.

The violent fluctuations of lumber prices is the greatest barrier to utilization. The average operation is underfinanced and can not withstand long periods of inactivity. When markets are stagnant many operators are forced by financial necessity to continue production and force their logs on an unwilling and congested market, which is always a critical market. When this state of affairs obtains, utilization breaks down from sheer economic necessity, beyond the power of the individual or the association of which he is a part to correct.

We have been pictured as despoilers of this great natural resource, reaping huge profits by ruthlessly slaughtering the trees, marketing the cream and leaving whatever portion our fancy dictates.

In rebuttal of the charge of excessive profits, I quote figures from the 1923 composite cost statement of one of the associations mentioned, which reveals on three-quarters of a billion output a net profit on investment of 17 per cent. This was one of the most profitable years the industry has ever known. Similar figures compiled for the first half of the current year reflect a net gain of 7 per cent, and the entire year will reduce that figure at least by half, if not extinguish it entirely.

And, to complete the picture, I might add that a similar composite statement of the West Coast Lumbermen's Association, reflecting the operations of 86 mills, who sawed most of these logs, and representing approximately two and a half billion feet output, made a net profit of 5.27 per cent in the year 1923, and for the month of August, on an output of 152,000,000 feet, these mills lost $450,000.

The question is asked: "Would better utilization on forest timber sales inspire private enterprise to do likewise?" It is true that a good example suggests emulation. Yet let me reiterate what I have stated before, both directly and by implication, namely, that we are removing from the land whatever it is possible to remove at a profit.

We who are logging privately owned timber are, in the main, the ones who will log forest reserves. The question is, can we do a better job of utilization of the National forests than we are doing to-day except through onerous impositions?

I have in mind a certain forest-reserve operation wherein the sales contract specified logs to be taken to 10-inch diameter and 16-foot lengths. At almost any stage of our logging market this is too close, for such logs, if many of them, will depreciate a raft to the extent of at least making it difficult to sell and quite probably result in a lower price for the entire raft. The logger mentioned learned this by experience and accordingly adopted the practice of leaving these logs in the woods, because for the past half year we have faced a log surplus and an attending critical log buyer. As a result, each month these logs were scaled up and charged to the logger, he paying the bill in preference to hauling them to market. I am informed that this operator has been ordered to haul these logs to salt water, paying freight, booming, and scaling charges thereon. The scaling bureau has refused to scale these logs because they are not considered merchantable. In my judgment, this operator is being imposed upon.

I make this criticism in the spirit of a free and friendly exchange of opinion, which I am assured is desired in this conference. Such a ruling may be characterized as the extravagance of the economical.

A contract to log the forest reserve timber must necessarily be binding in order to protect the Government and the public, yet it should be interpreted with some degree of leniency in order to avoid an example of misapplied zeal, such as I have related. It seems to me that the Government should take the buck and run of market conditions along with the logger.

In discussing fir sawmill waste, I have chosen the high spots as they appear to me. The head saw is the first offender, contributing heavy slabs containing more or less clear lumber. This practice has been minimized very greatly during recent years, both by closer supervision and by the installation of horizontal resaws. Many mills are further eliminating this waste by blocking out the log to permit of sawing parallel to

the side rather than to the axis of the log. This results not only in a greater percentage of upper grades but a greater board measure volume of lumber. The increased price of logs and increased lumber markets have also tended to diminish this loss.

Circular saws are extremely wasteful, and modern head-saw installations are of the band type, with a most obvious saving in lumber by reason of reducing saw kerfs. A large percentage of mills in the Pacific Northwest are of the older type, and modernization with band saws would no doubt over a term of years repay the first cost: yet each operator must be the judge of his ability to finance the change.

At the edger and automatic trimmer, the principal wastes, aside from the ever-present factor of carelessness in all industries, are excessive saw kerfs, and the system of edging and trimming for the purpose of raising the grade of the lumber. Improper grading at these machines produces waste. Likewise, the sacrificing of volume for grade produces waste. Many times at the trimmer 25 to 50 per cent of a piece may be sacrificed entirely, if necessary, and the remainder justify the loss. Therefore, the ultimate realization must be the yardstick by which we determine what is and what is not waste.

A more general use of gang saws would produce more volume by reducing the kerf, make more uniform lumber, result in less planing-mill waste, increase output, and produce vertical-grained stock. The latter-named feature is one of the most attractive results of gang sawing. If the entire output of a sawmill were of vertical grain, the common grades would be stronger, with less defects, and the clear selection would result in higher-priced lumber. Manufacturing certain types of logs into vertically-grained shop lumber rather than into low-grade dimension, results not only in increasing the price of lumber involved from $10 to $20 per thousand, but relieves the stocks in pile of a great deal of low-priced and at times unsalable lumber. This involves more intelligent and intensive headsaw operation, and better grading on the sorting chains and in the loading sheds.

Market extension activities in behalf of shop lumber must increase, however, for at present we have not developed a fir shop market equal to the potential mill output of this grade.

The drying of lumber, particularly in kilns, in many operations, is the most neglected and unscientific of any of the manufacturing functions. Antiquated types of kilns and even improper operation of modern types can be charged as the chief reasons for waste in this department. Faulty heat regulation and ventilation, "forced" drying, neglect in upkeep, improper methods in loading kiln cars, are the principal criticisms applying.

Forest Service compilations tell us that 5 per cent of the mill waste results from improper seasoning. It is my judgment that any kiln operation in which two or more batteries are involved can well afford to employ a kiln superintendent.

Much attention has been given to the subject of dry kilns by the Pacific coast planing mill conferences held for the past few years in our Pacific States, and the consensus of opinion resulting is that both the modern humidity type and the so-called hot-air type are efficient. Each requires intelligent management. A great many of these new types are being installed each year. Lumbermen are progressing.

In the planing mills the trim saws and faulty machinery are the two principal causes of waste. Here trimmers fall heir to some derelictions on the part of the other departments, which have failed to properly prepare the lumber, thus necessitating waste, for which the planing mill is not responsible. Appointments of planing mills have in some cases not kept abreast of high-speed planer installations, rendering 100 per cent intelligence in grading and trimming impossible. Ample sorting-table space should be provided whenever possible and particular attention paid to light and visibility and convenience of grading, trimming, and bundling. Modern high-speed planers have solved many of our problems by increasing output and improving grades, thereby reducing costs and increasing the realization factor. But here, again, we can not dictate the individual's course. His judgment must be final in determining replacements. These are the outstanding mill wastes.

As in the logging end of the game, I have endeavored to portray them frankly and without bias. In the quarters I have mentioned where waste occurs, improvement is possible. Yet I believe that a close inspection of our Pacific Northwest industry will reveal a very creditable standard of intelligence, and, when all the facts are known, as fair a measure of utili-

zation as can be expected under the circumstances.

It is my conviction that we should now pay less attention to the after-logging scene and the mill burners and direct our attention to conditions off the job, where an effort must be made to make it possible to save more.

There is much the Federal and State Governments can contribute; there is much the public can contribute; and backed by and working in close cooperation with these agencies, there is much we ourselves can do. Whatever is done should be worked out through the industry itself as the medium of expression.

We of the Pacific Northwest have certain definite handicaps to overcome. We are out on the end of the limb with respect to our consuming markets—2,000 miles from the center of population. Our freight rate handicap, compared to our principal competitor, using Des Moines, Ia., as representing a common competitive point in the twilight zone between the two producing regions, is $8 per thousand.

Our per diem wages are the highest paid in any lumber-producing center, added to which is the fact that we have for the past six years recognized the eight-hour work day. These are fundamentals which contribute to our costs as inexorably as the ebb and flow of the tides and contribute very definitely to our problem of waste utilization.

I have been asked to state what the Government can do to assist us. I would suggest, first, that it continue and increase its research in chemical processes by which by-products can be economically manufactured. This will be of benefit to us and our competitors as well.

The Madison laboratory is a splendid institution and has done much along these lines, by perfecting processes for producing alcohol, tanin oils, charcoal, and their like, from waste.

I see no reason why these laboratories should not create tests and collect data on laminated 2 by 4's and all sizes of dimension, even including timbers, and then assist us in carrying on a campaign to educate the public to use these articles, and, in general, educate our entire citizenship along the lines of work saving.

A survey of cut-up industrial and furniture manufacturing plants of the Nation might be made with a view to determining the possibilities of using our waste, and acquainting us with their requirements, for there is perhaps as much waste in these quarters in proportion to the total volume used as there is in our mills and woods.

The Madison laboratory some time ago conducted a dry-kiln test in the Northwest, working in cooperation with the operators. The results of this test have been very beneficial to our industry.

The Government might even go further and construct a modern sawmill, embodying all of the known machinery and processes, which would serve as an experimental institution, from which would radiate the benefits as the result of experiments in machinery and methods. The expense involved at first glance might appear prohibitive, yet experimental stations in behalf of agriculture located throughout our country are maintained by the Government, representing a considerable annual outlay. It occurs to me that some of the funds now expended in building forest roads might be applied to such a project.

Governmental agencies have compiled much valuable data on chemical pulp processes. But transportation seems to be the retardent factor here.

Spurred by the growing criticism aroused by small hemlock logs and trees left in our woods, a group of loggers in the Puget Sound district induced a survey to be made by one of the district foresters, and the report revealed that an average of 2,000 feet per acre of unmerchantable timber was left on 35,000 acres logged annually in one of our principal timbered counties, or 70,000,000 feet of material suitable for pulp, and that if broken logs could be economically gathered this amount might be doubled. An exchange of correspondence resulted between this group of loggers and prominent paper concerns of the United States in an endeavor to arouse interest, but without results. To my mind, pulp conversion is one of the most fertile fields for closer utilization. But our industry has gone as far as it can in this direction.

I am, in general, opposed to the principle of governmental subsity to private enterprises; paternalism begets dependence and encourages impotence. It is un-American. Likewise, I am generally opposed to Federal, State, or municipal governments engaging in business in competition with private enterprises. Yet we are here faced with a condition of waste which is admitted by all classes of our society as stupendous, and in the main at present beyond the possibility of

economic solution by private interests. If, therefore, public sentiment becomes insistent that this waste be utilized further, I am not so sure but that, in view of all of the conditions, the Government should tackle the problem and go into business.

During times of market inactivity our sawmills usually continue to operate, thereby producing surplus stocks; and inevitably the sales price drops, creating the very conditions under which waste flourishes—waste not only in woods and mill, but waste arising from cut-throat competition with each other, which ultimately reflects in closed plants, unemployment, reduced wages, with the inevitable reflex upon the butcher, the baker, and the candlestick maker.

Certainly the loss to society is far greater through this senseless state of affairs than it would be were we permitted to intelligently curtail our production rather than force it upon an unwilling market, with not only attending pecuniary loss but the inevitable let down in utilization. Our laws at present not only prohibit a concerted curtailment, but enjoin us from certain associated activities indispensable to the intelligent conduct of our business.

It is my firm belief that ere long enlightened public sentiment will demand that the Government insist upon our doing the very things we are now alleged to be doing and for which we are branded as conspirators.

To-day the utilization of our red cedar, a vanishing species because it is not reproduced readily, is impaired because of an illogical tariff situation which admits free shingles manufactured from lower-priced stumpage and by cheap oriental labor. Certain types of our cedar trees can not be marketed without waste except in connection with a shingle operation. Because of the situation I have mentioned above ,hundreds of shingle mills in our district have gone out of business. This is something for our Government to think about.

Our State governments can assist by giving relief from a system of taxation which has become confiscatory and is resulting in hurling upon the market stands of timber which, by all of the laws of the game, should be withheld for the future. Timber is held by most of our county assessors to be legitimate prey: the public attitude is "hit her while she lasts." Here, again, the public must be educated to the fallacy of this program.

I have purposely eliminated a detailed discussion of reforestation, for while it is so closely linked as to be almost inextricable, it has, nevertheless, been the subject of such profound thought and research for the past half decade by this industry and governmental departments that no discussion of it by me to-day is necessary.

The Western Forestry and Conservation Association, composed of lumbermen and lumber owners of the Pacific Northwest States, has for the past decade engaged in intensive forestry research, and to-day is representing half a dozen of our largest operators in a special study of their properties, with a view to launching a perpetual yield program consistent with enlightened sentiment. This institution is fortunate in that it is officered and functioned by the highest type of executives and technical men, who are keenly alive to the problem confronting them.

You will accuse me of being prodigal with suggestions as to what others can do for us in the scheme of making it possible to save.

I have purposely delayed until my conclusion to tell you what we have done and what we should yet do for ourselves. No product ever sold itself. The products of the fir region have come as near doing it as any. With our geographical situation, market extension is our salvation.

Five years ago we formed the West Coast Forest Products Bureau, with funds subscribed by all branches of our industry—timber owners, loggers, manufacturers, and wholesalers—for the purpose of preaching the gospel of our woods in the consuming markets of this country and of bridging that 2,000-mile gap. Thus our entire industry is solidified behind the movement, with a common aim and a definite realization of the benefits which will accrue to each constituent branch. We employ trained technical men, who spend their time in our eastern markets, learning their conditions and requirements and seeking new outlets for our product.

The story of the activities of this bureau is too extensive to detail here. I believe it is generally recognized as a forward step in the light of its beneficent accomplishments because it is digging at the roots of our troubles. Its ramifications include research with the railroads, car builders, and industrial plants. Of our product sold east of the Mississippi River, 75 per cent is sold on architect's specifications. Therefore we are cultivating the architects in an endeavor to convince them,

by records of tests made, that our wood is suitable to their uses. We have made an exhaustive survey of the uses of shop and cut-up material. All this field information has been relayed back to the operations on the job in order to coordinate the field work with the production end.

Our industry, in common with all other producing sections, has recently entered a standardization program, admittedly a most progressive movement, and one which has its very helpful reaction on utilization as well as service to the public.

Our West Coast Lumbermen's Association has for the past year instituted rigid grade inspections at the mills to promote uniformity in grades and to place us in position to give our customers what they order.

With these things which we have done for ourselves, backed by a definite cooperation from the State and Federal Governments, we should increase our budget for market extension and augment it all by an intelligent campaign of publicity. We have a wonderful story to tell, a story based upon facts and teeming with helpful information, to him who builds.

Given intelligent market extension, backed by equally intelligent publicity, the logging wastes and the mill burners will take care of themselves. The possibilities are boundless.

If nothing else. the history of the rise of wood substitutes which have been and are making such inroads in our sales, with the millions of dollars spent in their advertising, should convince us that we should fight fire with a flaming torch. We are missing our golden opportunity if we hesitate.

If I seem provincial in directing my remarks solely to the products of the fir region, it is both because I have been asked to do so and also because we have always found the splendid gentlemen representing the other lumber-producing regions of the Nation, whom we honor and respect, as men and as competitors, amply capable of speaking for themselves on any and all occasions.

I realize my remarks have been extended. I regret my inability to cover the subject without thus inflicting upon your time and good nature.

We of the Pacific Northwest are fully conscious of the importance of this movement. We are eager to do our share. We represent the last great stand and are conscious of the obligation thus imposed upon us.

We believe the problem is one which affects the entire fabric of our society, the essential elements of which must be parties to the solution. Society of to-day owes an obligation to future generations, to conserve and perpetuate this great natural resource, and we gain inspiration from the consciousness that a proper and lasting solution in the near future will constitute a heritage which we may with pride pass on to our posterity.

The following poem illustrates the spirit which inspires us in pursuit of this problem:

An old man, traveling a lone highway,
Came at the evening cold and gray,
To a chasm vast and deep and wide.
The old man crossed in the twilight dim,
For the sullen stream held no fears for him,
But he turned when he reached the other side
And builded a bridge to span the tide.
"Old man," cried a fellow pilgrim near,
"You are wasting your strength with building here.
Your journey will end with the ending day
And you never again will pass this way,
You have crossed the chasm deep and wide,
Why build you this bridge at eventide?"
And the builder raised his old, gray head,
"Good friend, on the path I have come," he said,
"There followeth after me to-day
A youth whose feet will pass this way.
This stream, which has been as naught to me.
To that fair-haired boy may a pitfall be.
He, too, must cross in the twilight dim,
Good friend, I am building this bridge for him."

REDUCING LUMBER SEASONING LOSSES

By CHARLES S. KEITH
President, Central Coal & Coke Co.

The subject given me for discussion on this occasion seems to be of a very technical character, but as I am not a technical man in any sense of the word I shall not endeavor to handle it in a technical way, but shall treat it in a more or less historical manner.

There is a general interest in the whole question of seasoning of lumber. This general interest may be subdivided into:

First. The interest of the general public. The public's interest is due to the fact that through proper seasoning a larger portion of the product remains in the higher grades, the supply of which is increased, and waste is reduced.

Second. The interest of the current consumer—the man who is building his home. Admittedly, seasoned lumber in house construction is an eco-

nomic necessity. Without seasoned lumber he obtains imperfect walls and cracked plaster, and his home is subjected to general shrinkage, while the material located at points where the air is excluded decays of dry rot. All of these things shorten the life of the home and create greater economic loss to him than the cost of proper seasoning to the dealer or manufacturer.

Third. The interest of the lumber dealer. To him properly seasoned lumber means a saving, compared with green lumber or lumber improperly seasoned. When he receives lumber which has not been properly seasoned and it is put on his yards, it is necessarily degraded through season checking, twisting, warping, splitting, discoloration, and dropping of knots. If the lumber has been sized at the mill when green, it suffers a shrinkage, resulting in scant sizes both as to width and thickness; and if it is piled on his yards and not stripped, rot ensues. Such conditions mean a severe monetary loss to him, and actually cost him more than the additional cost of properly dried stock. Consequently, from his point of view, properly seasoned lumber is almost a necessity, as it results in a saving in waste and lesser handling costs, and insures satisfied customers.

Fourth. The interest of the manufacturer. The manufacturer is interested in reducing his degrades, his production costs, his transportation costs, his capital invested in stocks, and his sales resistance.

(1) Degrades: The manufacturer demands of any artificial drying process, greater benefits or less degrades than from air drying. In the South the question of drying lumber artificially is a matter which has been developed during the last 30 years. It has proved successful, and has materially reduced seasoning degrades. In the West it is an innovation. The type of timber out there is different from that in the South. It is easier to dry the western lumber, as it takes less time to do it properly, but the degrades are greater than in the South because of the character of defects in the timber (i. e., black, encased, and large knots). The commercial value of the product when properly dried is greater than when green, and its shipping weight is less; consequently, the saving is substantial and more than pays a return on the investment necessary to provide facilities for drying.

(2) Production costs: The improved methods of yarding and handling kiln-dried lumber cost less than the older methods involved in air drying; i. e., piling and sticking.

(3) Transportation costs: The reduction in actual shipping weights per thousand feet of production results in lesser transportation cost.

(4) Capital invested in stocks and quick turnover: The ability to carry assorted stocks, enabling the manufacturer to ship lumber three to five days from the saws, means a vast reduction in the capital invested in stocks of lumber, with interest thereon and insurance on the stocks. The result of smaller stocks in proportion to production enables closer merchandizing and facilitates capital turnover.

(5) Sales resistance: The dealers naturally prefer properly dried lumber, as against green or improperly dried stock, for the reasons that it assures satisfaction to their customers, less cost in handling, and less loss by reason of seasoning degrades. Therefore, the dealer is or should be willing to pay a higher price to the manufacturer to insure relief from the degrades and other losses incident to handling green or improperly dried stock, as well as a quick capital turnover. These factors naturally reduce the manufacturer's sales resistance, increase his number of satisfied dealers, widen his territory of distribution, increase his sales realization per thousand feet, and reduce his cost per thousand of selling.

The necessity for seasoning lumber required a method of meeting it, resulting first in the development of air-drying processes. The air drying of lumber was not a perfect method, for the reason that seasonal conditions made lumber easier to dry in one season and retarded its drying in others. Experience demonstrated that when we had proper humidity and temperature conditions, with plenty of wind, we secured the best results from air drying. In certain climates where the winters were long, temperatures very low, and humidity conditions improper, it was impossible to dry lumber during such seasons. In other climates, where the precipitation and fog were great during the winter months, the lumber cut in October was still green in May of the next year. In some sections, chemical combinations in the wood, under improper seasoning conditions, caused discoloration, and it became necessary to find some method of drying lumber artificially in order to save the degrade resulting from attempted air drying.

The great variation in seasonal weather conditions did not lend itself to uniform conditions necessary to best results. This naturally led to experiments with artificial methods in an effort to produce constant conditions requisite to favorable results. This condition existed in the South and resulted in the development of the so-called "Arkansas smoke kilns." These smoke kilns, however, were extremely hazardous, and their use resulted in many fires and the destruction of property, as well as improperly dried lumber. The next development in the Southern States was that of the "hot-air kilns," using hot-air furnaces. This type of kiln, while less hazardous than the old smoke kilns, and more efficient, was very hazardous. Many fires originated therein, resulting in insurance rates, on such uits, of 10 to 12 per cent. Steam kilns were the natural successors of the earlier types.

The development of the thought of artificial drying versus air drying of high-grade lumber was for the purpose, primarily, of reducing the losses through degradation due to checking, twisting, discoloration, and other air-seasoning degrades.

In the earlier days it was thought impossible to kiln-dry common grades of lumber, but with the development of the steam kiln many of the operators in the South began drying their No. 1 common grades, for the reason that this process reduced the time that lumber had to be carried in stock, as well as the degrades incident to air drying. Eventually the process proceeded to the point where all grades of lumber, at some operations in the South, are kiln-dried, and we are getting better results from this artificial means than were possible from air drying.

The matter of artificial drying has been more or less in the process of evolution. One by one the difficulties have been overcome, until to-day we have the new forced-draft kilns, which give a more or less automatic and mechanical control of the necessary elements of drying lumber. In all methods of steam drying, we have had more or less control of two of the three necessary elements to drying lumber—i. e., humidity and temperature—but we were dependent entirely on natural circulation; and of the three elements entering into the drying process, possibly circulation is the most important element, and on account of this situation there has been developed what is known as the forced-draft kiln. There are several different kilns of the forced-draft type, but the best known are the northwest blower kiln and the new internal-fan kiln developed by the Forest Products Laboratory.

When preparing our plans for the construction of our new western plant, we called upon the Forest Products Laboratory to make exhaustive tests for us, and to give us the benefit of the results of such tests. We carefully considered the results of these tests, and after due deliberation decided that the internal-fan kiln was the best kiln available for our purposes. It is constructed so as to thermostatically control two of the three elements entering into the drying of lumber (temperature and humidity), and to mechanically control the third, circulation. The other types of forced-draft kilns have control of humidity and temperature, but do not have mechanical control of circulation; i. e., the ability to reverse the circulation. We concluded we could not secure even drying without control of circulation, and therefore decided to adopt the kiln developed by the Forest Products Laboratory.

The only remaining feature, in my judgment, to make these kilns perfect is the development of some character of automatic control of circulation, under a time-clock arrangement, so as to eliminate entirely the human element in kiln drying.

We had one of the internal-fan type kilns installed at one of our southern mills, and made a complete check of its operation as against our steam kilns in which we did not have control of the circulation, grading the lumber green before charging the kiln, and grading it dry after discharging it from this kiln, with the result that we came to the conclusion that by changing our 12 kilns at that plant over to the internal-fan type, at a cost not to exceed $48,000, we could save in that operation, through reduction in degrades, $105,000 per year.

In other words, our experience, generally speaking, has been that degrades may be very materially reduced through the use of the internal-fan kiln, as compared with the ordinary steam kiln. Our experience with this new kiln in our western operation has developed the fact that we are now drying lumber with practically no checking, cupping, twisting, warping, splitting, or discoloration. Large and loose knots that will check or loosen in air drying will do so with artificial drying.

When reporting the comparative tests which were made at the southern plant, the Forest Products Laboratory set forth the following results:

Grade	Per cent of degrade	
	Regular kiln drying	Internal fan kiln drying
B and better	18.1 to 22.1	[1] 4.7 to 7.1
No. 1 common	32.2 to 35.4	6.6 to 9.1
No. 2 common	28.0 to 31.3	4.7 to 11.3

[1] Includes 2.2 per cent degrade due to torn grain.

Even with the use of ordinary kilns, however, the degrades are considerably less than those resulting from air-drying. Of course, to secure the best results from any kiln, it is necessary that the supervision of the work should be most intelligently done. By "most intelligently done" is meant, under the supervision of a man qualified both as to tenchnical knowledge of drying lumber and practical knowledge of lumber.

It is our conclusion that there is no foreman in any sawmill manufacturing organization who is of greater importance to the company than the dry-kiln foreman. Drying lumber is no longer a "knife-and-splinter" problem, but one which should be of scientific exactitude.

Before closing my remarks, I desire to emphasize one or two subjects touched upon by several of the speakers who have preceded me. The necessity for large expenditures in capital investments in raw material and plant facilities to secure production, resulting in carrying charges thereto, together with constantly increasing tax burdens, creates an urge of production to provide funds to meet these requirements.

The increased public demand for good roads and better school facilities, together with the ready market for tax-free securities, is constantly increasing the tax rate, making it necessary to secure capital conversion and profit to meet these requirements.

The economic effect of unwise Federal and State trust laws and the uncertainty resulting therefrom prevent intelligent cooperative effort to prevent production in excess of the public requirements. For some unknown reason those charged with the responsibility of the enactment of Federal and State laws and with the administration of such laws fail to see that we are the only nation on earth which refuses to recognize that there can be restraints of trade in the public interest as well as opposed thereto. The only exception in this connection in this country are those exceptions which have been made to meet the demands of labor and agriculture.

No manufacturer of lumber who is familiar with the wide range of production costs due to the density and quality of stand of timber, topography of country, and proximity of timber to market would urge to-day the thought of either fixation of prices by agreement or by governmental action. On the other hand, while there can never be complete cooperation in agreements to control production to prevent overproduction, much could be accomplished both by agreement and by education. Certainly no one is so unintelligent as to require the manufacturer of lumber to produce more logs than his mill can manufacture into lumber, and why should any equally intelligent person require that lumber should be manufactured in quantities beyond the ability of the markets to consume? Yet this policy is the result of such laws.

Overproduction of any product naturally increases the urge and necessity to sell the product manufactured; such increased urge in selling naturally reduces values.

In the manufacture of lumber, certain proportions of the tree harvested through the lowering of values become unsalable, creating thereby losses in money greater than the loss of timber, and results in a direct timber waste. This loss could be stopped in periods of depression or overproduction if we could legally have had intelligent cooperation in a rational control of lumber production. It is my opinion that during the period of the last 25 years the average price for the total period under such a control would not have increased beyond the average price obtained, but would have resulted in an increased life of the industry of nearly one decade. It would seem, therefore, to me that the very first step in timber conservation should be a correction of unwise and uneconomic laws which not only permit, but force, waste through their operation. All students of current economics are bound to know that in many of their effects our antitrust laws are archaic.

SMALL SAWMILL WASTE AND A REMEDY

By JAMES H. ALLEN
President, Sterling Lumber Co

I am here as the representative of the Concatenated Order of Hoo-Hoo, which has an active membership of 9,000 lumbermen, and the ideas I express are as near the composite ideas of the thinking men of our fraternity as I can make them.

I first desire to qualify as a competent witness for Col. Wm. B. Greeley, who has spoken to us on waste problems. My reference to my personal affairs is made in order that I may qualify. I am vice president and general manager of the National Lumber & Tie Co., which has a contract to deliver to the Southern Pacific Railroad 1,000,000 ties per year, approximately 40,000,000 feet. We buy these ties from subcontractors, and 80 per cent of them come from mills that are cutting less than 10,000 feet of lumber per day. There are at least 100 sawmills cutting on this contract. I am familiar with their mode of operation, their manufacture, their distribution, and their waste; and I want to say without qualification that the statements that have been made here by Colonel Greeley and also those in the booklet, "Wood Waste Prevention," are conservative. This completes my case on small sawmills waste.

The interest shown in this conference is proof that there are patriotic men of faith and practical experience ready to serve the Nation if the opportunity is offered. Where is the convex lens that will assemble all of this patriotic zeal so that the rays may be collected and concentrated. Edison said that education through things that you see comes so much more easily than through things that you hear. Could this convex lens be a demonstration mill?

A lumber utilization plant should be built at some central locality tributary to many small sawmills. It should be financed by the Government of the United States, the State in which it is located, and the industries within the State, so that there will be a community of motives. This plant should be in charge of a thorough and competent lumberman, and under him there should be timber estimators, official lumber inspectors and graders, expert planing-mill machinery men, expert dimension-mill men, boxfactory men, flooring men, furniture men, competent accountants, a competent sales manager, a competent saw filer, a competent treasurer.

The object of the plant would be lumber utilization; it would be supplied with raw material by the small mills tributary to it. This would give a market to every small sawmill within the vicinity of the plant. The small operator not having sufficient capital to finance himself could ship his lumber to this unit and receive therefor a warehouse receipt and on the face of it the market price of lumber for the day the lumber was received would be shown. This warehouse receipt could be used as collateral by the small-mill operator with his local bank. After the lumber became seasoned, worked, and shipped, the warehouse receipt could be taken up at a price equal to the price obtained for it less cost of working and 10 per cent profit for handling.

To this unit the small operators could come at regular periods for instruction. Simple accounting could be taught, saw filing, setting-up machines, estimating timber—in fact, the different departments of lumber. At this unit a group of five or six mills in any given locality throughout the South or Southwest of the United States could be given a system of cooperation whereby, under their own supervision and capital, one planing machine could be put into a community, or two, or three, or whatever the raw material might require, with the purpose in view of creating in any given locality a bonded warehouse adjoining a finishing plant owned localy and cooperatively, if they should desire, whereby the neighboring small mills could ship in their lumber green and create collateral through that mill for operating purposes while their lumber was becoming dry waiting for its perfected manufacturing.

Small planing-mill units could be created under the instruction of this plant at many points throughout the lumbering districts of the United States, thereby stopping a large per centage of the mismanufactured lumber that is shipped into the consuming markets, and at the same time giving to the small sawmill man the opportunity to learn the importance

of better manufacture of lumber, through seeing the work actually accomplished at one of these units.

The small sawmill man, like the small farmer, loses much in the distribution of his product. He furnishes the substance, the raw material, but often the man who finishes the lumber, the man who merchandises the lumber, gets most of the profit. The small operator is entitled to a good price for his lumber and through this demonstration unit I have outlined here, where a sales manager would be in charge, those mills shipping into the demonstration unit would enjoy at least the market for their lumber that the large operator gets in these territories. And by taking this small mill man out of the market you remove a weak factor from the market. A strong buyer of a large concern buying lumber in the rough from a small mill operator is not fair buying and selling, but where a strong seller sells to a strong buyer that competition is fair, and this unit would develop that condition.

Shreveport, La., or Houston, Tex., are cities admirably located for such an educational plant as outlined here, and these cities you will find have prominent, successful, and patriotic lumbermen that will lend cooperation to the Government and the State, and you will find banking houses that will accommodate the small sawmill man. Short-leaf pine is growing rapidly in these localities; there are hundreds of mills adjacent.

What has been said here of the small sawmill operators is no reflection upon their ability, integrity, or standing. They are not equipped to care for the great responsibility that rests upon their shoulders. Much of the reforestation scheme of the Nation rests upon them. Especially is this true in the South and Southwest.

I happen to know this class of men very well, having spent the greater portion of my life with them. These small-mill operators are willing to endure hardships, to work, to learn, and to cooperate. They are a receptive class, ready to accept new instructions, new financial aid, new perfected mechanical devices and equipment. Here we have the Government, the State, and the industries within the States anxious to pass on enlightenment. Here we have a group of men anxious for the light. What is required? An impulse is all, and a plan to set in motion the theories and formulas advanced at this meeting.

Selling price is the great unknown quantity of the lumber industry that is creating more waste to-day than any other factor in it. To mention selling price requires a certain amount of boldness, for the Government and all sellers seem afraid to discuss this subject. I desire to make a personal prediction that some time right here in Washington shall be compiled for all of our basic industries, statistics comprising production, estimated future production, demand, estimated future demand, stocks on hand, sales, shipments, price of shipments, and then a conclusion as to what the price of each basic commodity should be; this price to be determined by deduction by competent, honest experts, employed by the Government of the United States. When that day arrives, the greatest variable in business shall be eliminated. Then each lumberman will know in advance how far he can go toward saving timber that is now being wasted.

To-day there are smart statisticians in the lumber industry and in the Government and in commerce generally. To them a rise or fall in the market is no surprise. They do their own announcing. Unfortunately for the smaller producers in the lumber industry, they have not, as a whole, the ability or expertness to draw definite conclusions from compiled statistics. The statistics of the Nation assembled in Washington are largely for the use of the large, shrewd buyer. The statistics are here, or they can be gotten here, from every branch of the lumber industry within a month—reports that would give the Government, through an expert statistician, very little trouble in estimating, for periods of six months, the approximate market price of our commodities.

Of course for an expert of this sort to make this announcement, it would be necessary for him to have the statistics covering the other basic industries of the country and the building trend of the Nation. It is a matter of enlightenment and wisdom. Recorded facts will produce this, and when enlightenment and wisdom have been acquired by any commission and the result of this enlightenment and wisdom is announced, it is bound to bring more safety and confidence to the whole industry represented and to commerce generally.

What is said of the lumber industry here with regard to selling price, as arrived at by definite, compiled statistics, can also be made true of the

agriculture of the Nation and so on through commerce. The banks want safety, the consumers want safety in commerce, and the Government wants safety in commerce. The only way to have absolute safety is to eliminate the variables wherever you can find them, and this great selling price variable is to-day the most disastrous hurricane in commerce; and when the time comes that the Government and commerce are willing to face each other and discuss this frightful, much feared demon, it will be found that through honest work in detail it can be overcome.

I am not a lawyer and I do not know whether a proposition along the lines I am going to make could legally be worked out or not, but I shall make it; and that is that if the Government of the United States, and some State, and some municipality within the State, will supply two-thirds of the invested capital necessary to put in one of these central wood-utilization plants, the order which I represent will undertake to raise the other third; and if you want men from our industry to sit on your governing board of such a plant we will give you a large number of volunteers of capable, practical, and successful men, who will gladly serve on such a board without expense to the Government of the United States.

It is my candid opinion that if we can create a lumber utilization plant of this sort it will act as the convex lens through which our patriotic zeal and whatever intelligence we desire to pass on upon this subject can reach the multitude of these small operators who need this educational work so badly.

WASTE PROBLEMS IN SOUTHERN HARDWOODS

By M. W. STARK

Vice President and General Manager, American Column & Lumber Co.

It is unfortunate that the public generally seems to think that the term "waste" as applied to lumbering operations means wanton destruction. The very fact that this conference is being held fully establishes the fact that the idea is a mistaken one. The lumbermen are deeply interested in waste problems and they welcome this conference because of the opportunity it affords to work together and with the Department of Agriculture in solving them.

The outstanding fact in better utilization of our timber resources is the necessity for cooperation of all units in the lumber industry, from the owners of standing timber to the ultimate consumers of wood and wood products. Without full and unselfish cooperation, little can be accomplished, because the major waste problems, and most of the waste problems, are intimately interwoven with the economic problems of the industry.

Our national problem is to convert our standing timber into its finished products in a manner that will produce the greatest utility value, which means to get from the timber the best possible in quantity and quality at a reasonable cost.

Only a part of this problem belongs directly to the lumber manufacturer. His problem is to convert his standing timber into lumber and other products in a manner that will produce the greatest utility value. The lumber manufacturer's measure of utility value is, and can be, only in terms of quantity and grade. It is vital that the grade standards to which the manufacturer must conform be true standards of utility value for the manifold uses of his product.

In hardwoods, the lack of right grade standards that have as their source of waste both at the sawmills and in the factories of lumber users. This waste will continue to be a wholly unnecessary drain upon our timber resources, as well as a heavy burden upon the hardwood manufacturing and consuming industries, until there is made effective a set of grade standards that have as their guiding principles what can be gotten out of the boards in usable lumber for the various consuming needs. This situation is now receiving the attention of the various branches of the hardwood industry in cooperation with the Departments of Agriculture and Commerce. The accomplishment of the purposes of this undertaking will be equivalent to adding millions of acres to our resources of virgin timber.

Another major problem in southern hardwoods is the utilization of slabs, edgings, and other material by manufacturing them into small dimension stock. While much is being done in this direction, the total of such material now utilized is but a small por-

tion of the amount available. The crux of this problem seems to be lack of understanding between the consumers and those who can or do produce the dimension stock. Many hardwood mills have tried the making of small dimension stock and given it up because it proved unprofitable. They ascribe the failure to irregular and uncertain markets; the difficulty of getting orders for the range of sizes they must make to get a fair yield from the raw material and a proper volume of production; the low prices they must accept for the stock compared with prices for lumber of inferior grade, difficulties over inspection, etc. Whatever the reasons may be, one fact is clear, and that is that there is burned annually a quantity of material sufficient to make many millions of feet of small-dimension stock having a utility value in excess of the cost to make it.

A large saving can undoubtedly be effected in the improvement of manufacturing processes simply by bringing about the general adoption of the best practices known to the industry. In the woods may be mentioned such things as cutting stumps low, preventing breakage in felling, cutting into logs so as to minimize the loss from crooks and other defects and utilizing the full length of the tree, preventing deterioration in the log, etc. In the mill the practices in respect to width of saw kerf, allowance for drying, methods of sawing, edging, trimming, etc., vary so persistently that they suggest very forcibly the wisdom of adopting standardized practices as a means of waste elimination. Time will not permit detailed discussion of these things, but there can be no doubt that they offer opportunities for considerable waste reduction, although the situation in respect to these factors is much better than it was 10 years ago.

Through the entire range of manufacturing processes there is need of technical study. Such studies may be expected to yield in saving of waste a return greatly out of proportion to the cost. It should be remembered that savings due to improvement in processes, when once established, continue indefinitely, and long after the expense has been forgotten.

A source of waste that is especially deserving of study is that which arises from the cutting of small timber. Such a study will undoubtedly disclose that much of the small timber cut to-day results in two kinds of waste. First, these small trees if left in the woods will be large trees in future years and will, therefore, yield a quantity of timber much in excess of what they yield to-day, and will also yield a superior quality. Second, it can be shown that the cost of cutting and manufacturing these trees is in excess of the realization from the lumber produced. The size which should be left will vary according to species, operating conditions, nearness of markets, and other conditions, but a careful study will make due allowance for all variable factors. This question has also a direct bearing on the important problems of the excessive proportions of low grades produced as compared with the demand.

The problem of low grades is one which deserves separate treatment because of its importance and the many complex problems involved. Its discussion can not be attempted here. It involves the question of grade standards; further refinement at the mills; freight rates on low grades; trees and logs that should or should not be left in the woods; and many others.

The utilization of the slash now left in the forest for pulpwood, acid wood, and other purposes is entirely a matter of markets. In some sections it can be gotten out profitably; in others the prices paid by the consumers of this material are insufficient to pay the cost of getting it out of the woods.

Irregular buying by some of the large users, notably the railroads, has been a potent waste factor and has a direct bearing on the problem of low grades. If it were possible for the railroads to purchase and receive their hardwood requirements with a degree of regularity, a great deal of waste could be prevented and the cost to the railroads for the material they purchase would probably be somewhat less than under the present system.

The economic position of the hardwood industry must be considered in approaching waste problems. The geographical distribution of the various units; the large number of different species and sizes manufactured; the instability of the market; the lack of adequate cooperation among the different units; the wide variation in market prices for any one grade at any given time; the lack of adequate information about market conditions, stocks available, prices, etc.; the keen and aggressive competition; the lack of uniform grade values; and other perplexing questions

are breeders of waste which it is humanly impossible to stop as long as these conditions exist.

No attempt is here made to consider the waste problems in hardwoods from the standpoint of the lumber user, excepting those that are involved with the manufacturer's waste problems. Two notable items in this class are, the establishment of right grade standards, and the manufacture of small dimension stock. It is worthy of note that different consuming factories very often use different grades of hardwood lumber for the manufacture of identical products. Until better grade of standards are established, the consuming factories must purchase lumber under the present grade standards and suffer the loss and waste incident thereto.

Study of the hardwood utilization problem will show that large savings can be effected through establishment of right grade standards; more general utilization of present mill waste by making small dimension stock; improvement of manufacturing processes; technical research; more careful selection of timber for cutting; improvement of the low grade situation and the economic situation of the industry. All these phases of the problem are well within the limits of what may be characterized as practical and reasonably attainable objectives. It cannot be stressed too strongly, however, that success can only be looked for through close cooperation of those interested in the various branches of the industry; and without such cooperation very little can be done. No one group can solve problems that touch so intimately every group.

The hardwood manufacturers are ready and willing to do their part. They welcome the opportunity to make this practical contribution to the conservation of our timber resources. They believe that this conference, in approaching the great conservation question from the standpoint of better utilization, is an epoch-making event in the history of forestry.

CLOSE UTILIZATION IN LAKE STATES HARDWOODS

By W. L. SAUNDERS
General Manager, Cummer-Diggings Co.

It is claimed by many writers that the lumbermen are wasteful and extravagant with Nature's products and that two-thirds of the forest products are wasted. This depends on what you call waste. I prefer to define waste as material which has been rendered either wholly or partially useless in the manufacture of products and articles of all kinds, but the name is sometimes retained long after a substance, at one time of little or no value, has been utilized.

In defense of the Lake States lumberman, I think he comes nearer utilizing the one-time waste than lumbermen of any other district with which I am familiar. There are in the Lake States a number of different processes of manufacture. I will try to describe the one with which I am most familiar and call it the unit system, consisting of a sawmill, chemical plant, and iron furnace (and generally a planing or flooring mill, but not always, as some manufacturers sell their lumber in the rough). The first requisite here is to own not less than 30 years' supply of standing timber to warrant the outlay in plant investment. With this unit well balanced, we are prepared to reduce waste to a minimum, as the forests of the Lake States are composed of many species of timber. The softwoods are manufactured into lumber and pulpwood, fence posts, railroad ties, etc., according to the species and demands of the trade, and generally logged very close. This leaves the hardwood to be dealt with more particularly, as it predominates in this district, as these States no longer produce much white pine.

Maple, birch, and beech being the timber we are most interested in, I will try to show you that there is nothing wasted. Commencing with the logging, everything on the land is cut clean as we go; the large limbs and all small timber, as small as 6 inches and very crooked, moves along with the saw logs, and any lumber that may develop in sawing up is saved as such. The balance goes to the wood-cutting machinery to be cut up into short lengths and into retort buggies, through dry kilns, thence through the retorts, where it is carbonized and afterward cooled, after which it is turned over to the charcoal iron furnace. We also produce wood alcohol and acetate of lime, both of which are used in the solvent and dye industry. By this process 10 days

from the time we fell a tree in the woods the so-called waste is converted into charcoal iron and other products.

It is in connection with the woodmill part of this operation that I wish to particularly call your attention, as it is here that considerably more can be saved to the lumber-using public. The crooked logs are first cut into short lengths, then worked up into wood; but as the use of dimension stock in the rough increases in demand the good cuts between the crooks and defects can be cut to proper lengths and worked up on proper machinery made for this purpose, thereby increasing the amount of good lumber and increasing the quantity of wood. I might say in passing that the publicity given dimension stock in this standardization campaign is having its effect, as many industries that can use some dimension stock in their business are beginning to see that it is to their advantage to be willing to pay more than a cull price for the material rather than have the impression that because the lumberman makes these sizes from slabs and edgings and cull lumber the product should be bought cheap.

This one-time waste, by the present unit plan, not only enables us to log closer but after all logging is done we go over our choppings with wood choppers and cut out of the tops everything that is left, down to the size of a man's wrist. We also reach out and buy wood stumpage and cordwood from lumbermen who only cut for lumber, until you can say that in the lower peninsula of Michigan there is little or no waste, and the furnaces there are going into the upper peninsula for a portion of their wood, as this field is not so well covered, but is rapidly becoming so.

I am frequently asked how much of the hardwood from the average forest goes into lumber and how much into by-products. I can answer this by saying that it varies in different localities, but as some of us freight in all of our raw material we can come very close to the percentages of each. Based on green freight weight as the material comes from the woods, the average will not vary much from 40 per cent lumber, 42 per cent wood, and 18 per cent sawdust, bark, and decayed portions. This 18 per cent is used in producing steam and heat for the process of carbonizing the wood and distilling the products and power for the sawmill, making these plants self-sustaining as to fuel. As it takes about 2¼ cords of wood to produce a ton of charcoal iron, and this district produces better than 250,000 tons of charcoal iron per year, we are using in this industry alone better than 625,000 cords of wood per year of the so-called waste.

While there are other processes of manufacturing followed in the Lake States, I am a firm believer in cutting everything possible from the land the first time over. It has proved very disastrous to attempt selective cutting, as much of the timber left standing is shallow rooted and blows over or becomes ill-shaped because of heavy tops and slim bodies—to say nothing of the fire risk, which is many times greater than in standing virgin timber.

As this conference is intended to bring out various ideas as to the best method of conserving the forests and to produce a larger amount of merchantable material, I can not help but again refer to the dimension mill as being able to solve this problem. A large percentage of the trees growing in our woods are so crooked that, when loaded on a sawmill carriage to be sawn into lumber, by the time they are straightened there is very little left, and that is the poorest part of the log. There are in my district a number of mills that cut all of their logs into short lengths, then saw them into sizes required for working into all kinds of dimension stock, then turn and dry and finish all of their material ready for the thousand and one things for furniture factories, etc. But as this field is fully covered, the next thing is to create a demand for rough dimension stock properly bundled and air dried. This can only be accomplished by a standardization of sizes, thus enabling the manufacturer to stock certain sizes the same as he does lumber, thereby assuring the consuming manufacturer a constant supply.

But the only way to induce lumber manufacturers to produce dimension stock in a large way is for the consumer to accept it in all stages of dryness as he does his lumber and not expect to have it kiln-dried as has been suggested.

To undertake this part of the work would take the hardwood lumberman into a field in which he has had no experience, and can seldom get sufficient volume to warrant the outlay for dry kilns and other equipment.

AVOIDING WASTE BY DIMENSION STOCK [1]

By EDWARD HINES
President, Edward Hines Lumber Co.

Before taking up the direct subject assigned to me—"Avoiding waste by dimension stock"—I feel that a few words of explanation would be helpful in the way of showing reasons why such changes have taken place in the lumber industry as to warrant a favorable consideration of the cutting at the mill point to special sizes or dimension in hardwood. Nothing in life is considered without an incentive. Cutting to sizes of hardwood dimension is simply another term for conservation. Conservation, in the broad sense, does not become operative until there is an incentive for it. Where an article of any kind is very plentiful, is selling at a very low price, and is located in such abundance near the point of consumption that the freight is hardly to be considered and even a saving in the material by having the stock cut at the original point of manufacture would accomplish but little, there naturally would be no incentive for conservation or cutting to finished sizes. Therefore, up to a short time ago the lumber manufacturers of the country did not consider seriously conservation or cutting to dimension sizes in hardwood, or, as you might say, to finished sizes, at the point of manufacture.

It seems only yesterday, as we visualize time (and one man's life experience is but a short space of time as time is measured), that practically all lumber, and particularly the hardwoods, used in the great consuming centers such as New York, Pennsylvania, Ohio, and Indiana were obtained from near-by forests. They were gotten out and manufactured in rather a crude way by small mills, practically all merely air dried and shipped in the rough to the manufacturing points. They were then kiln dried and cut up into finished dimension sizes and used in the finished product, whether a piece of furniture or some manufactured article in which portions were of wood. The price of lumber was so low and the cost of transporting it comparatively so low that there was no incentive to attempt to save by having the lumber cut at its initial point of manufacture, where, as is being done nowadays, it can be cut up at from one-half to one-third the cost for labor in the larger consuming or remanufacturing parts of the United States, such as the cities in the Northern States from Boston to Chicago. Secondly, the freight was so low that the question was not raised that a considerable portion of that freight could be saved by avoiding to transport the waste or that portion of the stock cut out as waste at the remanufacturing plant.

The consideration of dimension stock has only been brought about by a great change: First, by the hardwoods near consuming markets having disappeared, and supplies coming from a much greater distance, with freight costs several hundred per cent more; second, by labor costs being several hundred per cent greater at the remanufacturing or consumption points as compared with the sawmill or original point of manufacture; and, third, by the cost of plant in the way of ground, or the rental, in these larger cities being several hundred, if not several thousand, per cent more than the same ground costs at the sawmill points.

Hence, everything now is in favor of and offers actual incentive in the way of saving in dollars and cents by having the stock manufactured near the point of original manufacture. First, there is a saving in the original manufacturing cost in the sawmill where the stock is to be remanufactured adjacent to that sawmill. In Wisconsin, for instance, in birch and maple, in logs of the younger timber varying from 8 to 12 inches we cut up the logs alive, not edging it as we do the larger timber and sending piles of edgings out to be burned or to the woodpile. An ordinary sized tree, if not cut up alive and if the boards were sent through the edger, as was customary in the old-fashioned manufacture, would yield about a 1 by 4, 10, or 12 feet length, on account of the irregular width of the log, and this small timber would largely make a No. 2 quality, the lowest grade, owing to every piece having the heart in the strip, and such other defects as, under the rules for hardwood, would prescribe it a No. 3. This would sell at at the mill, under the present market, at about $18 a thousand. Suppose it

[1] Read by William S. Bennett, general counsel, Edward Hines Associated Lumber Interests.

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produced a 1 by 4, 12 feet long. That would make a final value of the strip 7.2 cents. Under the changed methods of remanufacture at the sawmill, we would cut that log up alive and not put it through our edges. It would go direct from the sawmill to the dry kiln. The first saving would occur then, because in going through the modern kiln the lumber, in about 14 days, would come out in fully as good condition as it went in: while if it had been put out in the yard in the old-fashioned way and left to air dry a matter of six months it would be more or less cupped, ends would be twisted, and possibly cracks would develop, that might make it even of a poorer quality than a No. 3. At least, if there was any cutting in it, it would be largely spoiled for cutting-up dimension; so, in quality alone it would depreciate.

On the other hand, when the board came out of the dry kiln, it would then be sent to the cutting-up mill. Instead of being edged first, it would be crosscut to such size as would yield the greatest proportion of wide, clear lumber all the way from 1 foot up to 4 feet long. As these pieces were crosscut, they would then go on a set of rollers to the next machine where we have some fine scroll band saws. They would be edged in the shorter pieces to bring about the widest width possible. Then the heart would be taken out, leaving from the bark to the heart that portion of the log which contains the clearest lumber. From our experience we have obtained, first, in lumber cut up in this way an average of from 25 to 33⅓ per cent more lumber, measured in the same way (in itself a striking lesson in conservation or saving). Second, instead of the strip making simply a 1 by 4, 12 feet long, of No. 3 quality at $18 per thousand, or a value of 7.2 cents, it has resulted in our cutting as high as 6 feet of lumber practically all clear and selling in the neighborhood of $70 per thousand, or netting $52 per thousand, or over twice as much in actual financial results. First, then, there is a saving of about 50 per cent in actual lumber; second, a change in the quality from No. 3 common to clear lumber bringing $70 a thousand, less the cost of kiln drying and remanufacturing, which, figuring even at $15 or $20 a thousand, still brings a net saving of from $32 to $37 per thousand.

In addition, the average run of logs naturally contains a much greater percentage of low grade or No. 3 than of the clear. The general market is always short of the higher-grade product, particularly in hardwood, which is used for the higher grades of manufactured articles. Necessarily, therefore the higher grade fluctuates less than the low grade, for which there is a very limited demand, it being used for but one or two purposes, such as boxing or crating, and coming into competition with all kinds of lumber for these purposes, whether hardwood or softwood. The clear dimension sizes of hardwood do not come into competition with all kinds of lumber, but with very limited kinds of lumber, and have a broad field of usefulness. Generally the finished product, used with other kinds of material, is but a small percentage of the cost of the finished article. It is wanted kiln dried; it is wanted clear; it is wanted finished completely; and the average buyer would sooner pay what looks like a high price per thousand feet because per unit it is a small item in the general finished size of the article in which it is a component part.

From our investigation (which was a little slow during the experimental stage), we are now convinced that by pursuing this course we shall be able to conserve timber because we will get a much larger percentage of finished product out of the log than in the old-fashioned method of manufacture. Second, we will get a much greater percentage of clear stock, always in demand, decrease our proportion of low grade generally, and give the trade what they want. Then there is the saving in freight. The offal, the low grade, is not shipped; and a saving is made to the public in general in not asking the railroad companies to carry a lot of waste which the public ultimately has to pay for in some form or another.

As time goes on we feel that this will influence us to remanufacture even some of the medium grades that are now being shipped in the rough. Another thing, in saving the freight, the so-called finished sizes are all dressed and kiln dried, weighing one-third less than the rough lumber; or, for the same amount per car you can get one-third more lumber at a given point in the finished size for the same freight than you could in the rough.

This illustration in hardwood is just a forerunner of what must occur in hardwoods from all over the country, whether shipped from Wisconsin to New York or any assem-

bling points in the Central States, or whether shipped from the hardwood forests of the South. What is true of hardwood will also necessarily be true of the various kinds of softwood.

Compare for a moment the saving in freight alone to-day as against 30 years ago. Then the lumber that was used from Chicago to Boston was largely produced from what was known as the Great Lakes territories, from Canada to Duluth, and was transported by boat in the rough, and many times green without being seasoned, at an average freight of not to exceed $2 per thousand. You can appreciate that under such circumstances there was no incentive to build cutting-up plants adjoining the sawmills. First, lumber was very cheap, and second, the transportation cost was practically nothing. Lumber could be transported from any of these points to Chicago, Detroit, Toledo, or Buffalo at practically the same price, and then by canal boat to New York City at about $1.25 more.

Think of the comparison in freight rates to-day. From any of our Southern States, on air-dried yellow pine, the average freight rate is, to that same territory, about 42 cents. The freight would be on an average $11 per thousand, or over 500 per cent more than formerly. From the Pacific coast, where next we must turn for lumber, the average freight rates to the same territory would be about 90 cents. The lumber weighing a little bit less, the freight would be less; it would be about $20 per thousand, or ten times as much as formerly. If there were nothing but a saving in freight to consider, therefore, there would be an incentive for cutting-up mills at the original point of manufacture. Many kinds of lumber could be kiln-dried and cut up into finished sizes and shipped at a saving in the quantity of lumber to make up a certain given size; the average quality of the material would be greatly improved, which would be another saving; also a greater amount of lumber could be gotten out of the log, a still greater saving; and then a saving in freight—all of which computed would mean a saving per thousand greater than what 30 years ago the finished lumber cost the manufacturer.

Such things, as I stated before, only come to light through changed conditions where the raw material is further moved from the point of consumption or reassembling; and when such changes take place an incentive can be given for a saving in quantity or in price. Then, and only then, will human ingenuity be influenced to give such thought to the subject as will change conditions in the manufacture, the curing, and the remanufacture to finished sizes to fit the ultimate consumer's immediate wants.

In connection with southern yellow pine we, of course, manufacture lath at both our plants in the usual way, and, in addition, in common with at least one of our neighbors, manufacture broom-handle stock. There are very few southern mills that go to the extent we do in the utilization of lumber. In the sawmills we save lumber 2 inches wide and 3 feet long. We also make plaster lath 32 and 48 inches; blanks for broom and mop handles, which take 1 by 1 inch and 5/4 by 5/4 inches, 2 to 4 feet long, and a few 50 inches long. We have been two years building and adding to our cutting-up mill at Lumberton, where we work into merchantable lumber low-grade stock, broken pieces, and material that would largely go into the burner, and that do go into the burner of the average yellow-pine mill. Ninety-five per cent of the yellow-pine mills in the South, of our class (that is, band mills), could utilize their stock as closely as we do. To illustrate, there are mills cutting timber exactly like ours and on the Clark international rule; they do not get any over-run, or not to exceed 5 per cent on their estimate, whereas we get as much as 20 per cent over-run. This over-run is a check on our utilization methods.

The trimmings in the planing mill are saved and in our cutting-up mill are worked into small-dimension stock. In 95 per cent of the southern yellow-pine mills these trimmings are used for fuel or sold for firewood.

So far, our operations in our cutting-up plant have not done much better than break even from a financial standpoint, but we have a long run ahead of us; we are practically through our experimental stage, and we believe that our utilization will, in the end, be profitable.

In our large mill plant at Virginia, Minn., where we manufacture white pine and mixed woods, we have sought the better utilization of wood for many years through different forms of dimension. At that mill plant we manufacture over 600 different kinds and sizes of lumber and dimension. As embraced in this particular paper, our utilization of short sizes and otherwise waste lumber for box lumber is probably most in line with your

thought. We save all lumber down to dimension a foot long, an inch thick, and 3 inches wide, some of this by the use of special machinery.

Our aim everywhere is the elimination of the burner. We have reached that point at our mills at Park Falls, Rice Lake, and Virginia, but only through the sale of firewood at Rice Lake and of fuel to a paper mill at Park Falls and to a public utilities company at Virginia. The burners stand because they are occasionally needed, but their use is rare. Our aim now along this particular line at all four of our operations, Park Falls, Rice Lake, Virginia, and the two mills in the South, is to utilize as small dimension the good lumber that goes into firewood, fuel wood, and into the burner, and I have given you a frank statement of the extent to which we have progressed toward that most desirable end.

The conservation of anything means, in broad terms, a saving, whether in the manufacture of logs into lumber, in the curing, or in the remanufacture; and these are therefore subjects for the general public's welfare. Speaking as one manufacturer, I feel I am voicing the sentiments of all, that they are keenly alert to these changed conditions, wishing to take every advantage possible, not alone for the public's welfare but for their own direct welfare, in the manufacturing and marketing of their product. They welcome study by the Government looking forward to any thoughts that will be likewise mutually beneficial to the public and to themselves. The Government, in institutions like the Wisconsin laboratory, can better experiment than any individual manufacturer. The manufacturers' interests are with the public in encouraging liberal legislation and expenditures to such institutions, feeling that the comparative expenditures will be but a small amount temporarily lent them, to be returned ten-fold in knowledge that the manufacturers, individually, can utilize for their own and the public's interest.

DIMENSION STOCK FROM THE STANDPOINT OF THE CONSUMER

By R. E. BROWN
Fisher Body Corporation

The use of dimension stock is not new to the manufacturer of wagons, furniture, and many other articles, but as applied to the automobile industry it is of more recent date. However, a great many so-called new ideas are only a later and more improved application of an old custom.

Most of the woodworking plants are producing dimension stock when they cut up the lumber in the course of the fabrication of their product; and most plants, if they are using good practice, are attempting in every way to reduce the actual waste in their plant to a minimum. However, it is rather surprising what a variance of waste can occur in different places using the same class of material; and the man on the job seems to control this to a large degree, by an analysis of what he has to work with and what he is required to get out of it.

So, granting that the present methods are good and that we are obtaining all that is possible from the lumber which we receive, there is one further step in the direction of better utlization in the form of obtaining dimension stock cut either from green, air-dried, or kiln-dried material, whether it be slabs, edgings, or lumber. The dimension proposition as it affects the automobile body work is already being applied more or less, undoubtedly, with different degrees of success. If such material as slabs and edgings are to be dimensioned this process must take place while the stock is green. If a plant producing dimension stock from the balance of a log cuts their logs in a different manner than the usual practice, they can undoubtedly obtain a greater utilization of the entire footage of the log. But do not be misled by the conception that an automobile body is made up of a group of little pieces such as can be gotten out of slabs and edgings, and while furniture dimension stock is in smaller sizes, body work requires quite a number of pieces of a good size, such as side sills up to 10 inches wide and 96 inches long, side roof rails up to 9 inches wide and 103 inches long, rear belt rails up to 6½ inches wide and 55 inches long, front and rear roof rails up to 5 inches wide and 61 inches long, body pillage to 9 inches wide and 54 inches long, door pillars to 6 inches wide and 51 inches long. These are the extreme widths and lengths, while the smallest sizes of these items would probably run 50

per cent of width and same lengths and some shorter, so it is quite plain to see that body work really requires a higher grade of lumber to produce it and a larger amount of large cuttings than a great many other wood-using industries.

The sizes of parts in bodies have been and are now being reduced as much as possible commensurate with the strength required. When it comes to a matter of attempting to get automobile bodies out of slabs, edgings, and low-grade lumber such as No. 2 common, No. 3 common and culls, we are attempting something which on the face of it is impossible. A few years ago bodies required No. 1 common and better lumber, with a good percentage of firsts and seconds to produce this work, due to the fact that all stock was cut free of season checks and defects. This order is all changed, and in some cases we are now using considerable No. 2 common and better, due to the fact that the wood in the bodies is nearly all, if not all, covered with metal, so that season checks do not show; neither do such defects as knots, provided they are sound. The present requirements on cuttings are more and more each year of a sound rather than a clear nature.

There are several savings to be taken advantage of in dimensioning stock at or near the source, which are the freight and possibly labor. The weight will be reduced, depending on the state in which the stock is shipped, whether dimensioned and dressed or completely machined, from 33½ to 50 per cent. This would make a saving in freight of from $5 to $7.50 per thousand feet of lumber required per job. This saving to our company, for instance, if the 200,000,000 feet per year used by them were all handled in this manner, would be from one million to one million and a half dollars per year. If the industry as a whole could do this, using possibly three times as much, the saving would be in proportion. One problem, however, is to get a fair commodity rate on stock which is finished ready for assembly, so that a higher classification does not absorb all the saving in weight. Our company is already manufacturing finished stock in direct connection with the sawmill, which means not only the greatest utilization of lumber, but the greatest possible saving in freight.

The matter of producing finished and machined parts at the source is something which the manufacturing consumer must handle himself, as he can hardly afford to be dependent upon outside sources, as it has been found very unsatisfactory in the past, and there is not room these days for very many profits in one article. We have found that it is not very satisfactory to even purchase kiln-dried lumber, because body work requires a thoroughly kiln-dried stock, and poor equipment and carelessness can work considerable loss. It is not such a hard task to produce dimension stock, but it requires equipment such as dry kilns, machinery such as cut-off saws, rip saws, jointers, planers, and band saws. Anyone can work to a stock list which gives sizes, kinds of lumber permitted in the different parts, and one soon learns the defects which can be allowed in the work, but some semblance of accuracy and pride in producing the dimensions properly must be made.

It can be said of automobile body industries that they are using practically every kind of hardwood. Substitution has been taken advantage of in every way possible, and in addition to the hardwoods many of the softwoods are also used.

The matter of price of dimension stock is one over which there has been considerable argument, due to the fact that a great many people seem to think that all dimension stock is obtained from No. 2 common, No. 3 common, and culls, and should therefore be bought at the price of those grades. The price of dimension stock can be arrived at if the average cost of the material, cost of kiln drying, waste, cost of machining, overhead, and a just percentage of profit are used to make up the ultimate price of the stock. If there is a saving in labor and freight it is due the consumer, to assist him in reducing the price of his commodity. Supply and demand will always govern prices, but the cost to the consumer should never be above what his cost would be on the same parts produced from lumber.

I believe the automobile industry can standardize many things to assist in the conservation of our timber. Individual companies can create more uniform design requiring a less number of thicknesses and in some cases can use thinner stock. The matter of face gluing for thickness and Linderman gluing for width will assist, and the substitution of steel in many places will help reduce the enormous demands of the industries on our timber resources.

There are many other points which could be touched upon in direct line with this work, and there are also some which come under the other fellows' jurisdiction, such as the large percentage of waste created in the sawmill. Circular mills cause more waste than band mills, due to saw kerf, extra thickness, and mis-cut lumber. Too many mills are forced into production during times of depression, due to either the expiration of time limits on their timber or improper finances which forced them to sacrifice in order to meet timber payments. The forests are possibly cut too close; they are peeled, instead of leaving such trees as nature needs to reforest itself. The resultant cleared lands are not needed; and as a beginning in our reforestation, would it not give us results quicker and cheaper if we saved and left them in the woods?

BETTER DESIGN OF CONTAINERS AS A MEANS OF SAVING LUMBER

By C. FRED YEGGE
President, General Box Co.

The responsibility of the packing-box manufacturer to conserve our timber resources, if measured by the amount of lumber used, is as great as any other industry. As a matter of fact it is greater than most of them, for about 15 per cent of the annual cut of lumber goes into boxes and crates.

The continued growth of manufacturing in this country causes a steady increase in the demand for shipping containers. The present demand for wood boxes and crates is making a serious drain in our rapidly diminishing forest resources. Any increase in the demand adds to that menace. It is already a grave subject for thoughtful consideration, and it would be indeed much more serious than it is except for the progress that has already been made in designing and constructing better containers of thinner lumber. This past progress encourages us to hope for even greater advancement in the science of construction in the near future.

The responsibility for initiating these newer designs and for developing and making possible these better practices in construction, necessarily is divided.

The organized packing-box manufacturers have met their responsibility in a manner entirely commendable.

The Federal Forest Service, through its research laboratories at Madison, Wis., has done its part admirably—has fully discharged its obligation within the narrow limits imposed by congressional appropriations. Shippers in many instances have encouraged the use of these newer ideas.

Yet, the full measure of these benefits can not be secured without the cooperation of the shipping public and the transportation interests.

The unorganized box manufacturers who are not applying the knowledge now in hand to the extent that is desirable may be divided roughly into two classes: (*a*) Any commercial manufacturer who is not an active participant in the activities of the trade associations of the box industry and who as a consequence obtains his information upon the developments indirectly and generally long after their announcement, if at all, and (*b*) the box and crate making departments of industrial or commercial establishments, frequently in charge of a foreman but a step or two above the level of a common laborer.

Neither a packing-box manufacturer nor a foreman of a box department can combine his materials and his labor to the best advantage by the rule-of-thumb method of designing and assembling box or crate parts. Nor can he be expected to apply these better methods unless he knows about them.

The necessity of reaching and educating these two great unorganized groups within the box-making fraternity is one of the problems of this conservation movement.

The shipper must welcome these progressive suggestions and canvass the merits of them without prejudice. He ought not to be contented with packing methods which met satisfactorily the conditions of his grandfather's time. Any container which has safely carried his products these many years is not the right package for him to use to-day because it certainly contains more material and has more weight in it than present practices justify, considering that the cost of both lumber and freight have more than trebled in a generation.

Likewise the transportation interests must be willing promptly to revise and amend and even discard many of the present restrictive requirements and regulations if the maximum ben-

efit from these newer and better designs of containers is to be secured.

The progress which has already been made in conserving lumber in shipping containers has been made in two ways: (1) By using thinner lumber, better nailed, reinforced in many cases with cleats, or with flat or round metal straps or wires; and (2) by the development of the so-called substitutes, the fiber-board containers.

A recent published report of the American Railway Association estimates that 31 per cent of all packages in transportation are made of fiber board and 34 per cent are wood boxes and crates. The remainder being composed of barrels, bags, bales, bundles, etc. Every fiber-board container necessarily conserves the amount of lumber required to make a box of that particular size. It is not possible to estimate with any degree of accuracy the total amount of lumber that would be required for containers if there were no fiber-board boxes; but the figures are large. Fiber-board containers are used for packing small units and light loads, while wood boxes and crates carry the larger and heavier loads. It would not be unreasonable to assume that so general a use of these fiber containers mean at least a 25 per cent difference in the lumber consumption in packages.

It was not so many years ago when practically all wood boxes and crates were made of the lower grade of sawn lumber, the higher grades determining not only the thickness but the species used in package making. The same thickness was used in large boxes carrying heavy loads and in small boxes carrying comparatively light loads, because these low grades of lumber had little value, for there was no other large demand for them.

In recent years, on account of increasing values, other industries using shop grades of lumber have reached down into those lower grades for raw material, thereby creating a broader market for them. Much higher freight rates and longer hauls to markets due to receding supplies have added to the increased costs. Then conditions, together with the diminishing sources of supply and keener competition, created a condition favorable for the progress in the industry which has been made.

About 9 or 10 years ago the Forest Products Laboratory at Madison, Wis., with the support and encouragement of a few of the leading manufacturers of shipping containers, installed a completely equipped testing and development laboratory for testing and developing packing-box construction. It quickly demonstrated that thinner lumber and better assembling of the parts made not only cheaper but stronger and more serviceable packages. It developed and demonstrated that there were certain definite fundamentals in box making and that boxes and crates could and should be designed and constructed according to certain formulas and that the old rule-of-thumb method must go into the discard.

The organized packing-box industry eagerly applied these principles and has conclusively demonstrated their economy and practicability in daily practice.

The first and simplest fact was that thinner boards than were commonly in use in boxes, better nailed, made stronger containers. All species of woods available for package making were grouped and their strength properties in boxes defined so that thickness might be increased or decreased according to the species used.

The kind, size, and number of nails to use was put into rules and charts.

The laboratory then soon demonstrated that when a metal strap or wire tie is used around the center of a box, reinforcing the nailing and the lumber, at least 25 per cent less material is needed. Furthermore, that two or three metal straps justified reducing thicknesses as much as 35 to 40 per cent, and that even thinner lumber might safely be employed if more metal ties were used, properly spaced and fastened so that the strains and stresses were evenly distributed. All this simply means that the maximum conservation of lumber in packages through the application of this principle finds its best expression in the wire-bound wood box, which is nothing more than thin lumber bound with many wire ties that are manufactured into an integral part of the package, anchored by machine-driven staples. This construction develops the greatest possible strength with an approximate saving of 60 per cent of the lumber required for the boxes of ordinary construction.

The use of rotary cut lumber in many of these containers is also a big factor in conservation, because that method of lumber production eliminates saw kerf and trimmings probably equal to 20 per cent of the log.

The use of reinforcing wood cleats in connection with panels of one or more ply permits the use of thinner lumber.

The more common form of the construction is seen in the cleated plywood cases. The frame of the box is made of fairly heavy lumber with 3-ply veneer used as sheathing. This 3-ply sheathing is usually about three-sixteenths of an inch thick and substitutes for inch boards. That in itself is quite a reduction in lumber. In the early development of this construction, the several plies were glued together after having been thoroughly dried. The best practice to-day is to glue these several plies together while green from the log, because that saves the 10 per cent shrinkage in the older method. That, too, conserves lumber.

All these newer and better practices in the construction of wood boxes and crates conserve lumber. The amount of lumber saved varies from 15 per cent to 60 per cent, depending on a number of factors too numerous to mention here.

It can safely be said that these newer and better designs of wood boxes and crates for the larger cases and the heavier loads, and the substitution of fiber board containers for the smaller units and the lighter loads, if generally applied, would conserve at least 50 per cent of the lumber that would otherwise be required for packing cases. The problem to-day is largely one of bringing about a universal application of the foregoing principles.

If the public is to reap the benefits of the progress already made, the unorganized box manufacturer, the shipping public, and the transportation agencies must be reached. They must be made to realize that their own interests as well as the public good will best be served if these underlying, fundamental principles of box and crate construction are understood and applied by them.

How can this best be done?

First. The research work must continue. No one, at all qualified to speak, would contend for a moment that all progress possible has been made nor that our present knowledge of efficient designs and constructions is complete nor that the fundamental principles on which they are based are all known or definitely fixed. Further studies at the Forest Products Laboratory and elsewhere are necessary. The organized box industry is supporting research work in its own laboratories and, in addition, is helping, as it has in the past, to finance such studies now under way at the Forest Products Laboratory. The proportionate share of the cost of such work which properly belongs to the unorganized groups in the industry or to the shipper or to the transportation interests must be shouldered by the Federal Government.

Second. We have the problem of making known to the unorganized branches of the box-making business and to the shipper and the carrier what has been accomplished and what may be achieved in the future of getting the individual actually responsible for the boxing and crating of products in each establishment to understand what has already been accomplished, how and where this knowledge can be practically applied in service and that this work should receive effective encouragement. Given a proper understanding and appreciation of what has already been accomplished, there would result an enlightened public opinion which would do more than anything else to bring about the solution of one problem in the very near future.

Third. Publicity is needed. The small body of organized box manufacturers is doing its part, but the task is too huge. We suffer to some degree from that lack of entire confidence in our claims to which any producer who is marketing his wares falls heir. Authentic information emanating from an impartial source, capable of broadcasting the message nation-wide, should find it easy to bring about the understanding and application of these principles. Witness how the country was converted by the economic value of the telephone and automobile. In the Domestic Packing Advisory Board newly set up by the Transportation Division of the United States Department of Commerce, and in the department itself, we trust we have the leadership so necessary to carry the truth to all. We thoroughly approve and commend the work of the Department of Commerce and all of the agencies cooperating with it in that enterprise.

Thus through the activities which have gone on before and through the results we hope to secure from further intensive study of these problems and through the publicity which must inevitably follow, the packing-box industry will do its full part to conserve our timber resources.

BETTER UTILIZATION OF LUMBER IN BUILDINGS

By JOHN M. GRIES
Chief of Division of Building and Housing, Department of Commerce

It is easy to say, and easy to prove, that timber could be better utilized in the woods, at the sawmill, at the planing mill, and in the erection of houses. But before the novice goes very far in the direction of better utilization he finds that many of his dreams come true only with added costs. In some cases the cost makes the plan prohibitive. But there is room for better utilization, and it can be brought about through the cooperation of the timber owner, mill operator, retail lumber dealer, contractor, engineer, architect, and building owner. With the Federal Government, State governments, and these private interests cooperating, a constructive program can be evolved and effectively executed.

Long lengths, short lengths, odd lengths, high-grade and low-grade lumber can be used in the erection of houses. Just where they can be used and to what extent must be carefully determined. High-grade lumber and long lengths have been used where they were entirely unnecessary. Not only was it a waste of an excellent product, but it resulted in the burning and rotting of billions of feet of highly useful lower grades.

The use of short lengths and low-grade lumber in construction is, in a floundering way, making progress. There are slight changes and minor improvements in utilization taking place from time to time, but the inertia of a custom, deeply implanted, developed during a period when timber was plentiful and all used lumber recklessly, is hard to overcome. It is difficult for the older people of to-day, who made free use of high-grade lumber when it was cheap for every conceivable purpose, to adjust themselves to present conditions when it is imperative to use our resources to the best possible advantage. These people will not be convinced of the necessity for better utilization of lumber by the mere opinions of interested parties. But these people are just as ready to be convinced, just as willing to practice better utilization of lumber as are those of the younger generation if the facts are clearly presented and signed by the recognized leaders of each of the groups interested in the construction of houses.

Progress in better utilization is being made. Yes, but it is slow. Every bona fide study made by a special group into the better use of lumber will be helpful. But if we expect to make the progress that the imperative conditions demand, the study must be a joint study. The report resulting from the study must have been pounded into usefulness by the lumber manufacturer, retailer, contractor, architect, and carpenter.

There have always been those who tried to tell the manufacturer of lumber what he ought to do without knowing anything about the business or what the cost would be. And there also have been those who have tried to tell the builder and the carpenter what they should do without knowing the cost. Many well-intentioned reports have been issued, somewhat one-sided, yes, but 90 per cent true and deserving of consideration. But they have signally failed, have actually done damage to a good cause because they expected the other party or group to do something impossible. One ignorant statement caused the report to be rejected completely. If there is cooperation in the study the ignorant statement will not appear.

There are several problems needing study, but the two of greatest importance, in so far as better utilization of lumber in construction is concerned, involve (1) production and (2) the use of lumber on the construction job. The educational work necessary to sell the lumber will be relatively easy if the other studies show clearly that such and such stock can be used to advantage. The problem is not half as much a production problem as it is a use problem and a merchandising one. The lumberman may not know just how much it will cost to use more of the tree, but he does know that he is leaving much in the woods which can be taken out if it could be sold at a reasonable price.

The Forest Service and its Forest Products Laboratory, forest schools, lumber associations, and others have engaged in research work, and are responsible for much of the progress made in utilization. The retail lumber dealers have made a contribution, and the architects have also helped. The work of all these agencies should be collected and supplemented by more research to fill in the gaps, and the results passed on by representatives

of all interested groups. The research must be carried on at both ends of the line—in the woods and mill, and in the construction of the building. The research in the woods and mill should show the architect, contractor, and owner the quantity of short lengths, odd lengths, and low-grade lumber that the mills could produce economically if it could be sold; and the research on construction jobs should show the lumber manufacturer the kind and condition of stock that the carpenter can use to advantage. All groups should have something to do with the planning of the studies, must act in an advisory capacity in their execution, and must agree and sign the findings. Every investigation conducted in secret by a single group will fail. The old idea that the dominating individual or aggressive group could alone educate all other groups is in disrepute. We are all skeptical of the forced-feeding method. Those to be educated, almost without exception, ask the question, "What's he trying to put over now?" This old idea—old custom—is passing. To-day the groups are working together with the Department of Commerce on standardization, for example, and the findings or results show that the problems and interests of all have been considered, and the result is the general acceptance.

The consumers of lumber are hard to reach because they belong to such a diversity of groups, and use the lumber in so many ways. There are small contractors who "carry their offices in their hats," large contractors with elaborate organizations, home owners, farmers, railways, public service companies, and Government agencies; and in many cases materials are specified by an independent engineer or architect, purchased by a second man, and used by a superintendent who may never have seen the other two before the job began.

Every lumber manufacturer building company houses should use the operation as a laboratory. He should permit those engaged in research work to keep records of the material used to advantage, together with any additional cost in the use of short or odd lengths. Contractors should also use some of their construction jobs as laboratories.

Not many years ago the quantity of lumber, dimension stock, and timber used in the construction of houses generally, and barns in particular, was much in excess of what was needed. Furthermore, millions of feet of clear, practically flawless lumber was used in the building of temporary shacks. I have seen clear lumber used for sheathing on buildings which were not supposed to stand for more than 15 or 20 years. To use clear stock for such purposes is a waste that should not be countenanced now. The insistence on clear lumber on the part of the builder compelled the mill operator and timber owner to skim the woods, wasting the low-grade lumber in order to provide the purchaser with the finest quality. The old buildings used framing material far heavier than was necessary; all dimension stock was full-sawn. A structure was produced which consumed far more material than was necessary to provide sufficient strength. In fact, billions of feet of lumber have been uselessly consumed in this way.

Many lumber manufacturers have earnestly tried to eliminate waste in the woods and in the mill, but they can do little without the help of the retailer and the public. Some day lumbermen will know that the additional labor costs makes it impossible for the builder to use certain material without increasing the labor cost to a point beyond the cost of other and better stock. Some day the public will learn that timber must be used as it grows; that you can not smelt it and roll it into any desired shape or length and leave the boards free of knots, pitch pockets, and shakes. The experienced and skilled sawyer can and does produce a higher percentage of good lumber than the poor sawyer, but even he can not eliminate all defects.

Every group has made progress during the last two decades in the better utilization of the wood that goes into our houses. Every group has made some attempt to make a better use of lumber—the manufacturer, the retailer, the contractor, the architect, and the builder. But progress is entirely too slow when dealing with a diminishing supply of raw material.

Public opinion for years gave little thought to the conservation of our forest resources. The conditions under which the people lived and the abundance of timber readily account for their views. We must judge the generations that have lived and died by the conditions they encountered.

Not so many years ago, in the timbered areas of the United States, the supply of timber was far in excess of the immediate needs of the communities, and judging by our present stand-

ards they were trained to waste it in every conceivable way. Thousands of acres of what we would consider most valuable timber was cleared off to make room for crops, and, except enough logs to put up the few necessary buildings, it was burned in the open or used in making fills for roadways. The only thought was to get open land for agriculture. There was no need for timber, but there was a need for corn, wheat, oats, cotton, and potatoes. And so they wasted it. Logs were used in their houses and very heavy timbers in their barns. Only the straightest trees and clearest stock of lumber were used. And under similar conditions most of us would have done the same. But conditions have changed; and even though this waste may have been considered necessary, such waste can not be tolerated to-day. During the last two generations we have gone a long way in the reduction of the quantity of lumber used in our frame buildings, and in the ever-increasing use of lower grade lumber.

Practically everybody in the United States is in favor of the conservation of our natural resources, provided we allow each to formulate his own definition. There have been many different groups of "blocs" among conservationists, including, among others, those who would rather see a tree die on the stump than to have it cut into lumber, and those who would conserve timber until the market for their competing material had become well established.

The city man goes into the woods and comes back bewailing the waste of timber. But he does not know what it costs to take what he calls waste out of the woods, and I regret to say that some mill men do not know what it would cost. The lumber manufacturer goes to the city and sees the waste on the construction job. He sees long boards cut into short and odd lengths and the indiscriminate use of high-grade lumber. He immediately wants to sell odd and short lengths. Often he does not know how much more it will cost at his mill and on the yard to handle miscellaneous short lengths. Again, he has few records, or no records, showing the costs of using short and odd lengths on the construction job as compared with the cost of using the standard even lengths of 12, 14, and 16 feet. It is also true that few builders have such records. As a result of this dearth of information, much free and worthless advice has been given to the lumber producer and about an equal amount of the same kind of advice has been given to the builder of homes.

We can not prescribe an economical use of lumber in our houses without knowing something about timber, its quality and production, and handling methods. Every sound recommendation for better utilization of lumber must be economically possible either in the woods or on the job, or both. What kind of timber have we in the woods? Trees are neither uniform in size, strength, nor quality. Waste frequently varies directly with the roughness of the country. There is not enough timber in existence, and there never will be, to provide clear, straight-grained lumber for all uses. What is the product of the sawmill? Some mills could not possibly produce 20 per cent of clear stock. They could not produce 5 per cent of timbers over 40 feet long. Notwithstanding actual conditions, there are some who seem to feel that the lumberman need only employ a Burbank to produce a knotless pine.

With the increases in the cost of lumber there is a tendency to use it more economically on the job, but custom has to a degree a strangling hold on those responsible for buildings.

1. There was a time when the yard-wide carpet exercised considerable control over the size of rooms; 9, 12, 15, and 18 feet were common dimensions. In order that the carpet should completely cover the floor, we wasted the ends of practically every standard length floor joist. To-day there are hundreds of house designs in which the architect deliberately plans for the use of 12, 14, 16, and 18 foot floor joists so that they can be used without waste. While this may be a move in the right direction, it is also quite probable that odd lengths could be used to great advantage.

2. Examine the floors of many of our old buildings and you will find wide boards. There was considerable objection not many years ago to the use of narrow widths or strips in floors, but this has largely passed. The use of millions of feet of lumber for high-grade use has been made possible through the acceptance by the public of the narrow and short-length flooring, and there is still room for much improvement.

3. Many men here can remember the day when much lumber was sawn so that it would dress a full inch. In the cruder mills this meant a cut of from 1⅛ to 1¼ inches in thickness. Scant

sawing has greatly increased the quantity of lumber which can be produced from a given tract of timber. If scant sawing saves lumber, and the dimension stock and boards provide adequate strength and protection, let us save the timber. Of course, there is no true economy if scant sawing is carried beyond the point of safety. Custom again enters and becomes the millstone to progress.

Builders have used heavy timbers in the past, clear siding and sheathing, full-sawn dimension stock, even lengths and long boards, wide stock and clear stock. With the old models in mind, it is difficult for them to adjust themselves to the point of prescribing the use of smaller dimension and short and odd lengths in construction. Too frequently the home builder has felt that any urging on the part of the retailer for him to use narrower stock or a lower grade was solely in the interest of the retailer.

The purchaser of lumber, however, has made considerable progress in his acceptance of many of the recommendations of lumbermen, and he will accept others more rapidly if an unprejudiced report is presented to him showing what can be done economically, especially if this report is signed by all parties interested in lumber and its uses. While some progress has been made, the condition of our timber supply necessitates the more rapid adoption of better practice.

Cooperation is essential. Short lengths and odd lengths will not come into common use until the manufacturer, the retailer, and the designer of houses work in cooperation or along the same lines. The logger is not going to instruct his logging crew to cut 13-foot logs where 14-foot are impossible as long as the retail dealer refuses to order such stock; and the retailer will refuse to order odd lengths as long as the purchaser or consumer refuses to specify such stock; and the designer, be he architect or carpenter, refuses to specify odd lengths as long as he has no assurance of getting delivery. In fact, the designer has more than once been disgusted when he ordered 9-foot studding, and 18-foot lengths were delivered and he was billed accordingly.

In the heavy timbered areas of the United States, it is not the practice to cut logs into odd lengths. Although the 13-foot log is known in the Adirondacks, it is practically unknown in the South and West. If only even lengths were salable, it often happens that an extra foot of good lumber is lost in the woods. If the log includes a serious defect or knot, it will lower the grade and seriously affect its use if the knot in included. The sample studies which have been made on the job show very clearly that there is a place for much odd-length stock. This is not only true of dimensions and framing materials, but of boards. Considering the present design of frame houses, the purchase of odd-length floor joists would frequently be an economy.

Short lengths are being used in house construction, and much more can he used economically. The question of short lengths assumes greatest importance in small timber and in low-quality logs, and much less importance in tall timber containing a high percentage of clear stock. The manufacturers of hardwood flooring have found it possible to market short lengths. The use of short lengths in the softwoods is not so extensive.

Some time studies have been made covering the laying of floors. Sample studies on the job show that in the use of short stock, if not end-matched and not assorted into multiples of lengths, the cost of the labor involved in floor laying more than offsets any gain obtained from the use of such stock. If these sample studies are an index of general conditions, it means that the manufacturer must produce the stock ready to lay, end-matched, and the retailer in making the sale must sort into lengths suitable for the particular job. Studies also show that fully 40 per cent of the boards used in small frame houses are less than 9 feet long and many are of odd length. There is comparatively little room for short-length floor joists and studding, although in many farm buildings and in some of our city residences more short-length studding could be used..

All lumbermen are acquainted with the work on standardization which has been accomplished after prolonged investigation and consideration by bodies representing producers, distributors, and consumers. The general acceptance of the standards already adopted not only will save lumber but is becoming a distinct advantage in construction. The organization developed for this purpose has proved its soundness and its value, and is in a position to assist in research and adoption of a program in regard to better use of lumber in building.

It will be unnecessary to discuss protective features, for other speakers will discuss them. The prevention of

rot and decay, the use of paint, preservative treatment of timbers, and fire-stopping methods are all of interest in construction.

In conclusion, I will briefly state that the need for better utilization of lumber is imperative. It can be brought about through cooperation. All groups are interested in the problem and are now working together as never before. A program has been outlined involving a study of short and odd lengths. It is already under way, and in my opinion the findings will be such that they will be accepted by the lumberman, contractor, architect, and others. The outlook is promising.

BETTER UTILIZATION THROUGH BETTER MACHINERY

By H. C. ATKINS

President, E. C. Atkins & Co. (Inc.).

The idea back of this assembly of those interested in saving our timber supply is an idea that lies back of one of the most important problems in this country. It is time that real constructive thought and concerted effort should be devoted to both saving our present supply of timber and developing a further supply, not 25 years hence, but now.

My purpose here is in the capacity of a manufacturer of saws for cutting and preparing wood for various uses. In that capacity the many problems of ways and means for doing this work with the least waste are up for solution every day. Great progress has been made, particularly along the line of saving in remanufacture of wood products after the lumber has been cut at the mill.

Suppose we start with the cutting down of the tree in the woods. In this operation, leaving out of consideration the art of lumbering itself, which includes the knowledge of what trees to cut and how to cut them, we really have but one problem to solve in the prevention of wood waste. That problem is the height of the stump to be left in the woods. Logging is now done with the crosscut saw. This tool now cuts a minimum of kerf and really the width of kerf in the height of a tree is negligible. What is wanted is a low stump. There seems to be a limit to the height of the stump under present methods of cutting, owing to the difficulty of operating a two-man crosscut saw nearer than 12 to 18 inches from the ground. The sawyers just will not do any better, even when trees grow so as to offer real value for the extra food or 18 inches saved.

For 15 years we have done more or less experimenting to develop a power machine to do this work. We have built three chain saws operated by gasoline, air, and steam. All have worked to the point of cutting down a tree, but all have developed operating problems that so far have proved very discouraging—mainly, the first cost and upkeep. Our last trial was with a chain saw, really a link belt made up of saw teeth operating over sprockets driven by gasoline motor. This device was tested in Carolina pine, West Virginia hardwood, and Louisiana pine; and when the direct question was put to each timberman: "Will you buy one or two machines at $1,200?" only one answer was yes, and that yes was qualified by such stipulated guaranties that a manufacturer would hardly dare to undertake the risk.

We tested narrow-band saws mounted on portable frames driven by gasoline power, but to no purpose, as the saw is too light to make a straight cut and so can not be controlled. So far, the best arrangement is a chain saw.

We built a circular saw machine to carry a saw, rim driven. It can be done, but unfortunately trees for the sawmill are not cut in the city park where the cutters have free passage. Machines for logging have to be carried around in rough hilly places tangled with undergrowth. Our latest attempt was to try a long cable shod with teeth which could be operated by a donkey engine 500 to 1,000 feet away. It can be done, but only at the risk of breaking up more timber than could possibly be saved by a low stump.

To sum up this whole matter of logging, it comes to one conclusion. Low stumps can be attained by the use of a chain saw, driven by a gasoline air-cooled engine. But the saving of timber is offset by the extra cost of operation.

Passing that phase of wood waste, we come to the manufacture of lumber itself after the log is cut and delivered

to the mill. Here we begin to make our calculations on economy and to get the most for our outlay. There are many types of mills, each installed in a way calculated to best serve needs of the owner, the place, and class and quality of timber.

First, the small circular mill set up to cut isolated patches of timber where a large operaton entails too large a capital investment to justify its existence. Here perforce the sawing must be done with a round saw where the minimum thickness is 10 gauge (about ⅛ inch). This means a kerf of at least a scant ¼ inch to every cut. Saws as thin as $\frac{3}{32}$ inch can be used, but at a very considerable loss of time owing to slow feed and, worst of all, danger of greater loss by reason of miscuts. You ask, why use a circular saw? Because a band-mill equipment again brings the capital investment higher than can be paid back with a profit and also adds to the cost of operation by reason of upkeep and labor. Experience has shown that such operations are self-limited in the way of kerf economy beyond a certain point.

When we reach the point where a band mill can be profitably installed, kerf economy can be reached in the making of boards over the use of a circular saw. Now, how far can this economy go? The thickness of a band saw is not primarily determined by the tensile strength of the material, as modern band saws are made of material which at the proper temper has a factor of safety way beyond any possible strain that can or will be required for sawing. With a tensile strength of 150,000 pounds to the square inch of cross section at the weakest point (the braze), it is scarcely probable that the maximum strain of 10,000 or even 20,000 pounds on the mill, with a strain of twice as much when the saw hits the log, would cause any damage to a saw 12 inches wide and $\frac{1}{32}$ inch thick. It is not the development of a better material for the blade, but a knowledge of the reduction of friction both to blade and bearings that will help. Friction is the bane of a sawmill, and its elimination the answer to more saw problems than usually supposed.

Friction causes heat, and heat causes an expansion of the steel where the heat is applied. This spotty expansion distorts the blade—hence miscuts. Friction is caused by lack of tooth clearance, improper or insufficient dust-carrying spaces between the teeth, tight guides, improper alignment. So employ only the best mechanics for your saw fitting and tensioning and avoid miscuts and too much allowance for dressing lumber after it is sawn.

To run a thin saw, naturally the stability of the blade must be such as to insure straight lines and no miscuts. Hence common practice has come practically to a stop at a 12-inch head saw, 14 gauge, or a 14-inch saw, 13 or 14 gauge. Where 15 or 16 inch blades are used in large timber, the gauge is as heavy as 12 or 11 gauge (one-eighth-inch). A heavy blade has the backbone, as it were, to stand up to heavy feed in a deep cut without dodging when strained at 10,000 pounds, which common practice has set as the limit to the strain which the bearings of the mill will carry without undue heating. New engineering has increased this strain limit as high as 20,000 pounds safely by the use of ball and roller bearings. With 20,000 pounds strain a thinner saw will stand the feed better, as the lack of body in the blade is supplemented by the extra tightening.

Not long ago a mill builder sold a new mill which was equipped with antifriction main bearings to enable the operator to put 20,000 pounds strain on his saws and to enable him to tighten up a 17-gauge saw to the point that it would stand the feed of a 14-gauge blade. The operator's first saws were 17 gauge, and later he went back to 14 gauge. I asked him why. His reply, dated November 8, 1924, was: "We discontinued their use, as our timber contains a lot of nails driven into the trees by turpentine men for fastening the cups to the trees, and the 17-gauge teeth do not stand up for cutting nails as well as the heavier saws."

You are going to experiment more as time goes on, and you are going to try thinner saws with more carefully designed tooth shapes, but your logs must be free from nails. Twelve-inch band saws as thin as 19 gauge have been used successfully on mahogany and rosewood, but those mills have reverted to heavier saws because the Africans and other heathen left too many nails, arrow heads, and other junk concealed in the logs.

In this case in particular, where 14-gauge saws had been the rule, a 17-gauge saw was used successfully with no reduction in speed or feed, or a saving of one-sixteenth inch in each line. The great trouble, however, seems to be that thin blades perforce have thin teeth. Heavy feeds

require large gullets for dust space, and large gullets mean narrow teeth. These thin, narrow teeth are weak and apt to run out of line and make washboards. If mills now using 11-gauge saws reduce to 14 gauge, the kerf is reduced from fifteen-sixty-fourths to eleven-sixty-fourths inch, or one-sixteenth inch is saved on each line. This means that two boards would be saved in cutting inch boards from a 4-foot log. But what does the mill man really do when he runs a big mill with a 16-inch by 11-gauge head saw? He slabs on the head saw and one-half of the extra kerf goes to the slab. He cuts his cants on the lighter gauge resaw, or gang, and in doing so makes not to exceed five cuts with the heavy blade, with a loss of only five-sixteenths inch, of which two-sixteenths inch is in the slab.

If his resaw or band saw uses a 14-gauge saw and he substitutes a 17-gauge blade the saving in kerf is again three-sixteenths inch to each line, or out of 6 cuts 48 inches wide and 8 inches thick, the saving on each cant would be two boards 8 inches wide, or 12 boards to the log. If the log is 16 feet long the total saving would be 130 feet of lumber. This seems worth while, but the result is always attained at the waste of time and speed. It is purely a matter of judgment where the operator ceases to save lumber and starts to save wages and time. Much timber in kerf can be saved by reduction of swage on the teeth. Light swage means frequent swaging, hence work for the filer. Most filers prefer to spread the teeth wide and reswage after three to five runs. For instance, a 12-gauge saw 0.109 inch thick will run with three-sixteenths inch swage, but it is always started at seven thirty-seconds inch.

Mill operators do not always have logs free from sand, dirt, and small stones; therefore the filer can not be blamed very seriously if he plays safe by swaging a saw 0.115 inch thick out to one-fourth inch and then shapes back to 4-gauge so he can be sure to make his four or five-hour run and not have to reswage except after every third or fourth run.

In large mills the logs go to the head saw for slabbing and squaring up and cutting into cants, or flitches. These cants then go to the resaw, usually a band of lighter gauge, or to a gang saw of lighter gauge than the head saw. On both these machines there is a saving of kerf over cutting up on the head saw. But frequently the mill is equipped with a battery of heavy circular saws termed a "bull edger," usually a very heavy gauge, some mills using saws cutting as much as three-eighths inch kerf. Here is speed, but tremendous waste. Better slow down the speed of cutting and use more machines with less kerf operating more slowly.

Along this line, consider carefully the use of sash gangs down as thin as 18-gauge for cutting flitches or cants into thin boards. Horizontal band resaws may be somewhat hard to manage at times, but they pay. They, as slab resaws, make lumber from waste, where the sawyer has slabbed too heavy, whether from necessity or error. Twin bands and tandem machines on white pine are right now using 3½-inch bands 23-gauge. Some have gone lower for box work on white pine, but here again the teeth are too weak.

Another very important feature that does not always have proper attention is the question of straight work from your edgers. Much timber is wasted by crooked feeding of the work through the edger. Mills must be so designed that after the lumber leaves the head saw there must be space and time to carefully sort the boards for edging, trimming, and grading. Don't pile the edger man up so he can not get out from the pile without a chance to use careful judgment. Give your timberman time to look at his work and not cut and slash without discrimination. Too many mills, when set up, save at the spigot and leak at the bung, as it were, because the tail end of the mill is too small to handle the output of head saw and resaw.

The biggest waste in a sawmill is in the slabs and edgings. Install slab resaws to utilize the waste. Install manufacturing plants to work up the small stuff. Let lumbermen seek out uses for the product that otherwise would be wasted, and accumulate carloads for specific uses.

To sum up, I fear you will think I am dodging the real issue, or the question as to whether a saw manufacturer can save waste by so making saws that they will cut less kerf. We can cut always at a loss of speed in production.

We have demonstrated to our own satisfaction, and the satisfaction of mill operators, that where an 11-gauge band saw is being used at the present time a 14-gauge can be used by reducing the feed and cutting more slowly. The saving in kerf between

11 and 14 gauge is one-sixteenth inch to each line. Where 14-gauge saws are now used, 16 or 17 gauge can be used with a saving of one-sixteenth inch of the kerf, but always at the expense of speed.

In sawmills where circular saws are used, a very material reduction in kerf could be saved by the use of a band mill. In England, where timber is scarce, a very different method of getting out lumber is used. Large logs are cut into very wide boards on band-saw mills, using comparatively narrow and very thin saws. The speed at which the timber is cut is very slow, but the timber is saved. The saw manufacturer is every day solving some problem or other in reference to timber waste.

A manufacturer of toys, getting out toy villages, found it necessary to cut out a great many thousand pieces five-eights inch square and about two inches long, using white pine, which cuts very easy. The writer found them using three-quarter-inch boards which were being ripped into three-quarter-inch squares the full length of the board and then put through a four-sided sticker. The way these squares are being made now is to surface a three-quarter-inch board two sides to five-eighths inch and then run it through a gang of smooth-cutting ripsaws, obviating the necessity of further dressing entirely, leaving the squares finished ready to cut off, and the saving of more than one-eighth inch on each kerf.

The remanufacturing problem on timber lends itself more readily to this saving of timber by reducing the kerf and saving of timber by cutting out dressing operations through the use of smooth-cutting saws than in the sawmill operations themselves.

The manufacture of slats for blinds and the flat stick that is used at the bottom of a window shade has been accomplished by sawing these flat sticks from the wide boards by means of a smooth-cutting ripsaw absolutely without the necessity of any dressing whatever, so that the elimination of the dressing operation alone has saved fully 10 per cent of the material cut up for this thin stock.

There are a good many problems which if put up to the saw manufacturer could be solved, but there are a good many more problems where the operator must of necessity choose between speed and economy of timber—speed meaning economy of time as against the possibility of saving timber by taking a little more time to do the work. This is such a broad subject that it is a difficult matter to cover it technically and fully in a short time, but I hope that a little insight has been given to the problems that are continually met in any attempt to conserve lumber.

There is a word that I would like to add, even though I am only a saw man. Perhaps it may come from me with better grace than from you lumbermen. It is this. May the time speedily come when the question of taxation of cut-over lands may be made so easy to the lumberman that he can afford to raise another crop. I would like to see such a man protected to the point where he would be immune from taxes as long as he needs to grow his crop and taxes only collected as and when he markets the new crop in the shape of a sales tax on the lumber cut and sold.

THE RAILWAYS AND WOOD PRESERVATION [2]

By R. H. AISHTON

President, American Railway Association

The railways of the United States have a very large and real interest in the timber output of the country, and in its preservation and utilization to the best advantage. Not only do the railways haul by rail a large proportion of the annual timber cut, in the form of lumber and other forest products, but, what is more important for the purposes of this discussion, they are the direct or indirect purchasers of a quarter of the total lumber output. The railways expend more money for lumber than for any other kind of material except fuel.

A number of special studies have been made by the Bureau of Railway Economics in this field. During the year 1923, the large (Class I) railways of the United States purchased approximately 2,388,800,000 board feet of lumber, for which they paid nearly $100,000,000. About 113,900,000 crossties, both hewn and sawed, were also purchased, for which the railways paid about $125,000,000. For other products of forests, such as poles and posts, the railways in 1923 spent nearly $8,000,000 more. The total

[2] Read by Dr. J. H. Parmelee, director, Bureau of Railway Economics.

direct expenditures of the railways for forest products thus amounted to about $233,000,000.

Assuming that the average crosstie contains 32 feet board measure, the ties and lumber purchased directly by the railways in 1923 amounted to approximately 6,000,000,000 feet. During 1925 the sawmills of the United States produced approximately 35,000,000,000 feet of lumber, which does not include hewn ties. If it be assumed that the total production of lumber and hewn ties was not more than 40,000,000,000 feet, it would appear that in 1923 the railways purchased directly about 15 per cent of that total production.

These figures cover only the direct lumber purchases of the railways. If the lumber purchased indirectly for the railways by equipment manufacturers and railway building contractors be included, these figures would be increased considerably.

In this connection let me say that two years ago the Bureau of Railway Economics made a special study for the President's unemployment conference, with reference to the stability of railway employment and of railway purchases. In the course of this study the normal annual purchases of various kinds of materials during the five-year period from 1910 to 1915 were ascertained. On the basis of these figures it is estimated that the railways purchase directly 17.5 per cent of the annual timber cut of the country, and indirectly purchase 7.5 per cent, or a total for both direct and indirect purchases of 25 per cent.

If these statistics are indicative of the situation at the present moment, then the railways absorb about one-fourth of the timber cut each year, and expend nearly a quarter billion dollars for lumber products of various kinds. Their interest in forest conservation is therefore no small one, and any effort on their part looking to a longer life of the ties and other lumber they use is well worth while.

Fortunately, it can be shown that the railroad companies were pioneers in the wood-preserving game, and that they have been actively engaged for more than 85 years in developing methods of wood preservation.

Railroad attention to wood preservation began in this country in 1838, when kyanized chestnut ties were laid down on the Northern Central Railroad in Maryland. Its value was demonstrated 11 years later when the ties were examined and found to be sound, while untreated ties had become useless. This particular incident is of interest for two reasons; first, because it shows that the railways were among the first, if not the first, to experiment with the problem of wood preservation through chemical treatment; also because the original experimentation took place within a short distance of the National Capital, on what is now a part of the Pennsylvania Railroad system.

The first treating plant in the country worthy of the name was established in 1848 at Lowell, Mass., by the proprietors of canals and locks there. It consisted of two wooden tanks, each 50 feet long, 8 feet wide, and 4 feet deep, in which lumber was immersed in accordance with the kyanizing process, using bichloride of mercury.

From these modest beginnings have evolved the scientifically planned wood-preservation plants, 135 of which were in operation last year; 29 of these are owned by railroads and specialize in the treatment of railroad material. In addition, the railways patronize privately owned treating plants, where work is done for them under contract.

The year 1923 was a banner year in wood preservation by the railways, according to the Forest Service. In presenting the statistics, showing a 34 per cent increase over 1922 in the number of cubic feet treated, the Forest Service said:

"The railroads, the pioneers in the wood-preserving field, have long been cognizant of the economic value of treated wood. As a result, the bulk of material subjected to preservative treatment to-day consists of crossties, crossing plank, bridge and trestle timbers, and similar products of the forest in structural form essential to the very existence and continued operation of the transportation system of the country."

Since the railroads have been pioneers in wood preservation, their records and studies are sought by other industries that use timber in quantities and hence are forced to consider the elements of economy. Viewed as a whole, these records and reports on processes, specifications, mechanical preparation of ties and timber for treatment, properties of treated woods of various kinds, and methods of combatting marine borers, to mention a few of the subjects which have engaged the attention of railroad men in connection with wood preservation, afford distinct contributions, not only to more efficient and economical uti-

lization of timber, but also to the sciences of chemistry and biology.

Moreover, the results of these investigations are readily available to those interested, in the published proceedings of the American Railway Engineering Association, which is the engineering division of the American Railway Association; the American Wood Preservers' Association; and similar associations.

In the early years of their investigations the railroads worked practically alone. There was no Forest Service in 1838, when the Northern Central tried out kyanized ties, nor was there one in 1848 when the Lowell canal proprietors built their little treating plant, nor even in 1867 when the Southern Pacific established its burnettizing plant. In fact, while individual roads had been investigating processes and treating lumber for years, it is only within the past 25 years that definite progress has been made and an extensive interest in the subject has been taken.

When the American Railway Engineering Association—then known as the American Railway Engineering and Maintenance of Way Association—held its first meeting in 1900, the committee on ties reported that the subject of wood preservation was one of lasting interest, to be studied over long periods of time with annual progress reports. Discussion of this report brought out the fact that data from individual roads were available, and that the material collected by Octave Chanute, a consulting engineer of Chicago, on European practice—for all ties in Europe are treated—was at the disposal of the committee.

By 1909 the material had become so extensive, and the continued study of the subject required so much effort, that the American Railway Engineering Association established a committee on wood preservation, with instructions:

"To cover in general the investigating and reporting on the preservation of wood used for ties and for railroad structures and buildings, confining the work of the committee more particularly to processes, methods, and results obtained.

"To present a recommendation as to the outline of the work for the committee, with suggestions of the classification to be followed.

"Continue the work heretofore done by the committees on ties and on wooden bridges relating to the special subjects of processes and methods of wood preservation."

From the work of the railroads in studying their own problems and in cooperating with individuals and associations working along the same lines, have resulted specifications for preservative treatment of various kinds of woods. These are included in the manual of the American Railway Engineering Association as recommended practice. Detailed data are constantly being added, based on the service records of railroad ties.

Investigations of mechanical treatment of ties and timber were made necessary by the fact that a treated tie may be destroyed by mechanical action long before it decays. The first report of the committee on wood preservation said:

" * * * The present general American method of rail fastenings is not ample and not efficient. It is essential in order to obtain the full economic life of a preserved tie to improve the fastening by providing greater bearing surface and by the use of screws or screw spikes."

More spectacular than these quiet and exhaustive investigations, which have been of such value in determining more effective utilization of wood on land and in fresh water, are the investigations in which railroads have been participating, along with the Forest Products Laboratory, shipping concerns, and even the Chemical Warfare Service, into methods of checking the ravages of marine borers.

These tiny and destructive creatures have long been known and studied by individuals. But, as in the case of the railroads' early work in connection with wood preservation, no thoroughly organized scientific effort was made until threatened disaster goaded those concerned into activity.

With the increase of shipping in various harbors came an increase in the destructive activity of marine borers, and the study of these borers underwent first the process of investigating and correlating existing data, and then the drafting of recommendations in regard to preservatives and construction materials.

Studies are being made on the Atlantic, Pacific, and Gulf coasts and the National Research Council has been cooperating. The Chemical Warfare Service, through its studies of war gases and chemicals and their effects on living tissues, has accumulated data which are apparently of great value in the peace-time war on marine borers. Meanwhile, the railroads are continuing their investigations and reports, both on measures

for temporary protection against the borers, where expense of permanent protection is not justified, and on methods of permanent protection.

Thus the railways have been actively engaged for years on every phase of the problem of wood preservation. In fact, it is not too much to say that they have been the leaders in the movement. Such a statement finds its support, among other things, in the fact that 90 per cent of all the lumber which is treated each year in the United States is railway lumber; that is, is utilized by or for the railways in their construction and maintenance work.

Turning to some of the specific subjects related to the treatment of forest products, the following extract from a report made in 1919 by Mr. George Yeomans is of interest. Mr. Yeomans, who at the time was assistant director of the Division of Purchases of the United States Railroad Administration, and was discussing the establishment of a bureau for the purchase of crossties, said:

"The use of treated crossties has steadily increased since their introduction 34 years ago until, at present, about 33 per cent of the total number used each year are treated. This has had the effect of reducing the number to be procured annually for renewals by over 20,000,000 ties, and the extension of the use of preservative treatment to the remaining two-thirds of the yearly supply would result in a still further reduction of about 45,000,000 per annum."

Statistics from the Forest Service of the United States Department of Agriculture show that 53,610,175 railroad crossties were treated in 1923, which was 12,293,701 more than were treated in 1922.

Reducing these ties to cubic feet, and adding all other forms of timber which were subjected to preservative treatment, it appears that the total amount so treated by the railways was greater in 1923 than for any preceding year of record.

The statistics are as follows for the years 1909, 1914, 1919, and annually through 1923:

	Railway material treated (cubic feet)
1909	75,946,419
1914	159,582,639
1919	146,060,994
1920	173,309,505
1921	201,643,228
1922	166,620,347
1923	224,375,468

It will be noted that the increase between 1909 and 1923 is almost 200 per cent.

The cubic feet of timber treated in 1923 were distributed among the various classes as follows:

Crossties	160,830,525
Piles	9,569,443
Poles	26,886,904
Wood blocks	4,932,307
Cross arms	420,206
Construction timber	18,837,795
Miscellaneous	2,898,288
Total	224,375,468

The foregoing table indicates not only the extent to which timber treatment has been carried by the railways, but also the many forms of lumber and timber to which such treatment has been applied.

Much is said these days about saving all if you save the surface, and more attention is being paid by all industries to painting as a means of improving appearances, sanitary conditions, and lighting.

But long before there was any widespread general interest, the Master Car and Locomotive Painters' Association, organized in 1870 to discuss paint in all its relations to railroad purposes, had been studying painting processes and formulæ, and testing them year after year.

Remembering that wooden cars were generally in use up to recent years, it is not too much to say that a large part of our available knowledge regarding the value of paint as a wood preservative is due to the efforts of the painters of the railroads. The Master Car and Locomotive Painters' Association was merged into the American Railway Association in 1920, and its proceedings are now known as those of the equipment painting section of the mechanical division. These proceedings, along with the 48 other volumes issued by the association under its own name, afford to those interested an extensive excursion into applied chemistry, and the adaptation of painting methods to climate, usage of equipment, and buildings for railway purposes.

Another group of railway men who are interested in paint as a preservative of structures, wooden and otherwise, is the committee on buildings of the American Railway Engineering Association. They have recommended a form for recording all painting work done on railway buildings in order that unsatisfactory paints can

be eliminated, and that the appearance of railway property protected by paint can be kept up to the highest standards.

About 10 per cent of the crossties fail by reason of mechanical wear. Mechanical wear means the cutting into the tie by the rail and the killing or disruption of the wood fibers by spikes driven into the wood, which thus open up the interior of the wood to the action of the fungi, eventually cause decay and hasten failure of the tie. Decay breaks down the structure of the wood and weakens it beyond the power to withstand mechanical wear. The two processes of tie destruction facilitate each other. Mechanical wear thus undoubtedly hastens decay, and reduces the life of the tie by several years.

To overcome this difficulty, railroads are now using a tie-plate inserted between the rail and tie. Without a device of this character, many of the softer woods now used for crosstie purposes could not be utilized. Improvements in this device are being constantly made to afford even greater protection.

Railroads have found that the handling of materials is one of the most important questions in obtaining the maximum life of lumber and timber. The results obtainable depend in a large measure on the care given the material after its delivery to the railroad. Maximum results can not be expected if the material is abused while stored and handled. Bearing this important fact in mind, regulations have been formulated and promulgated to the track forces, indicating specifically how the lumber and timber is to be stored, piled, handled, and installed in the track.

In many situations it has been found feasible and economical to substitute other materials in place of wood for railroad purposes, thus reducing the drain on the timber supply.

For example, steel is being largely used for passenger and freight car equipment. Concrete is being employed to an increasing extent for buildings, trestles, piles, docks and wharves at rail-and-water terminals, coal chutes, water tanks, fence posts, telegraph poles, etc. These substitutes not only release wood for other uses, but reduce the fire hazard—an important consideration.

No satisfactory substitute for the wooden crosstie has as yet been developed. Engineers, however, are giving this subject earnest thought and study, and it is believed that eventually a satisfactory substitute will be the result of progressive development.

Railroads traversing forest regions are vitally interested in preventing the spread of forest and field fires. As many forest fires originate on or near the railroad right of way, it has been natural for the railroad to combine with the State and other organizations in providing protective measures for this work. In certain States, this obligation has been placed upon the railroad companies by State laws.

The legislation on fire protection affecting railroads is generally along the lines of requirements for locomotive spark arresters; for devices for preventing the escape of fire from ashpans and fireboxes; the prohibition of depositing fire, live coals, etc., on tracks or rights of way; the requirement of screening smoking-car windows, cleaning right of way, extension of cleaning at dangerous points to strips beyond the right of way; maintenance of fire patrolmen to follow trains in forest districts during the danger seasons, and notification by trainmen of fires observed in passing. Railroads are cooperating in these various ways to prevent the destruction of property by fire.

Numerous ways in which railroads have conserved timber might be cited, such as the reclamation of old material and again converting it to some useful purpose so as to utilize it to the limit.

A number of railroads have undertaken tree planting and reforestation on lands owned but not required for railroad purposes.

It is a far cry from the simple methods of the Northern Central and the Lowell canal men to the complex activities of the Chemical Warfare Service, but the railroads have played no inconsiderable part in bridging the gap through the 85 years that they have provided investigators, money, and materials for the ever-expanding and ever-important subject of wood preservation, to the end that our timber supply may be utilized to the utmost.

The attitude of the railways in the past is a very clear indication of their policy in the future, particularly regarding their interest in the matter of wood preservation and conservation, which, briefly stated, is the utilization of every effort and every channel that will produce greater economy and efficiency in the operation and maintenance of the railway.

PREVENTING DECAY LOSSES IN PULP AND PAPER MANUFACTURE[3]

By D. C. EVEREST
Secretary and General Manager, Marathon Paper Mills Co.

The subject assigned me relative to preventing decay losses in pulp wood and wood pulp is one which is being studied with great care by those engaged in the manufacture of all classes of chemical and mechanical wood pulp. Decay losses occur in every stage of timber life, including the standing timber in the forest, the pulp wood stored along tracks or rivers or in the mill yard and, in the case of stored mechanical pulp particularly, in the finished product itself. The Bureau of Plant Industry has estimated that 10 per cent of the annual cut of pulp wood is needed each year to replace the decay loss occurring during that year. When we figure the amount of timber this represents, we realize the necessity of expending every effort to overcome this situation as far as possible.

The financial loss is not the only loss to be considered. If we were dealing with an inexhaustible raw material supply we would not be so concerned, but we are exhausting a resource which is not being replaced, and some time we shall arrive at a point where manufacture from timber can not continue. It therefore behooves us to do those things which will delay that time as long as possible. Perhaps we may awaken in time to do the things which will bridge the gap of no timber production, but if so we must make our start promptly and with a determination to continue the work consistently.

The subject of preventing decay was brought prominently to the attention of manufacturers through the work of the Forest Products Laboratory about six or seven years ago, and there has been constant improvement in the handling and storing of both pulp wood and wood pulp since that time.

The savings possible through proper yard sanitation were so apparent that the improvement in yard storage conditions was taken up quickly and has resulted in enormous savings to pulpwood owners. The cost of properly arranging a wood yard for piling pulp wood and logs so as to permit of a circulation of air between the piles, elevating the piles above the ground by means of skids, and covering the ground with cinders or other materials to keep down the vegetable growth and the removal of old bark and débris from previous piling has been so small that immediate financial benefits were received; and, naturally, where such a condition exists you are bound to get prompt cooperation.

The introduction and use of barking drums as against the use of knife barkers is another simple innovation which has reduced the wood losses due to barking tremendously, and it seems to me as though a conservative estimate of the saving affected would be from 8 to 10 per cent of the wood used, and of the best wood in the tree. This proposition, like the sanitation of the wood yard, was a saving which could be readily appreciated by the mill owner and was promptly adopted.

In the production of wood pulp against the work of destructive fungi, the savings made have not been so apparent, and research work along that line still continues. It is a fact, however, that the discussion of this problem has brought about much better storage conditions for pulp in the various plants throughout the country. With the supply of pulp wood in this country constantly diminishing, it is a shame that anyone should today permit pulp wood to deteriorate in value while stored in the yard, due to fungi or other causes, and it is even more serious to permit wood pulp to decay after all the expenditure necessary to convert it from pulp wood to wood pulp. The Forest Products Laboratory is entitled to the credit of having brought to the attenitон of the manufacturer this great economic waste and of having outlined plans whereby much of it might be overcome. It is reasonable to suppose that the annual financial saving will run to many million dollars, as well as the conservation of timber which can not readily be replaced.

There is also another forest pathological problem which is in urgent need of investigation, and, if possible, solution. That is the problem of forest diseases. The losses from insect pests, tree diseases, and timber rot is enormous. With the establishment of forest experimental stations throughout the country, we will have the means of studying these pathological

[3] Read by O. M. Porter, assistant secretary, American Paper and Pulp Association.

problems, providing pathologists are added to the working staffs of these stations; but we who are interested in the perpetuation of the forest resources of this country must see that ample financial support is given these agencies to carry on their work. Only a few years ago it was necessary to finance the Forest Products Laboratory by private subscriptions in order to carry on the investigation of causes of decay in pulpwood and wood pulp. Such a condition should not exist.

Complete utilization of such timber as is cut or destroyed in the course of logging should be the aim of those who are in charge of cutting the forest resources of this country. In the pulp industry there has been a constant effort to utilize new species of wood, and the work of substitution of species promises to prolong the life of the industry very materially and possibly to such an extent as to bridge the gap between the life of the present stand of timber and the time when we shall begin to cut from reforested or protected lands. It is particularly interesting to note the development in the use of hardwoods, jackpine, and various southern pines in the manufacture of pulp. The future of the pulp industry lies in the full protection of our present growth, and the proper storing after cutting, in the substitution of species, and in complete utilization of what we do cut. The pathological work incident to this study can be carried on through the present established governmental agencies, but it must be borne in mind that these agencies must have adequate appropriations. The amount of saving in the value of products with which they are dealing is so enormous that those who fix the appropriations for such work are apt to lose their sense of proportion and not set aside sufficient funds for the work.

Thrift in the utilization of timber is to be commended, but too much economy in the expenditures of those agencies which have to deal with the conservation of resources which are being rapidly depleted is not a practical proposition, nor does it make for the economic benefit of the country.

There is one other thing which will undoubtedly be developed in the pulp industry which will do much for complete utilization of timber in building materials. As it is to-day we are dependent on the physical condition of the log and the mechanical means of cutting it up, for the quality of the lumber produced, but it seems fairly certain that within a comparatively short time substitute building material of uniform grade may be made from the good material in low-grade logs, slabs, trimmings, etc., and thus effect an enormous saving in the forest products necessary for building purposes.

The research departments of every paper and pulp manufacturing institution as well as the Forest Products Laboratory are constantly working on the problems of timber conservation, and there are several very promising ideas being developed at this time. Increased yield of pulp per cord of wood is one of the very important items under consideration, and the modification of the chemical treatment bids fair to bring this about. To-day less than half of the actual weight of dry wood is available as pulp after the chemical treatment. Here, certainly, is a chance for improvement and real conservation.

It is my firm belief that more has been done in the pulp and paper industry in the last 10 years looking toward conservation of timber than was done in the whole prior life of the wood-pulp industry, extending over a period of nearly 50 years. It is also my belief that the next 5 years will see more done along the line of extending the life of the pulp and paper industry in this country than has been done to date.

Education through association work such as that carried on by the technical division of the American Paper and Pulp Association or the woodlands section of the same association will do much to hasten the conservation of timber in pulp making. Common sense has taught manufacturers the necessity of prompt action, as they see the immediate financial gain even if they do not appreciate the far greater future benefit, and I believe the wood-pulp industry may be depended upon to cut down their losses and really do much toward the conservation of our present and future timber supply.

REPORT ADOPTED BY CONFERENCE

At the opening session of the conference, Secretary Gore appointed a temporary committee on permanent organization and program, composed of the following members:

A. C. Goodyear, president, Great Southern Lumber Co. (chairman).

A. R. Joyce, vice president, Joyce-Watkins Co. (secretary).

O. E. Bradfute, president, American Farm Bureau Federation.

O. M. Butler, secretary, American Forestry Association.

E. L. Carpenter, president, Shevlin-Carpenter-Clark Co.

Harry B. Curtin, president, National Hardwood Lumber Association.

E. J. Curtis, vice president, Curtis Co.

W. Z. Georgia, president, National Wood Chemical Association.

Elliott H. Goodwin, president-vice president, Chamber of Commerce of the United States.

Henry S. Graves, dean of the Yale Forest School.

Charles H. Herty, president, Synthetic Organic Chemical Manufacturers' Association of the United States.

E. C. Hole, secretary and manager, The American Lumberman.

John E. Lloyd, president, The Wm. M. Lloyd Co.

B. F. Masters, chairman of the board, National Association of Box Manufacturers.

Dr. John C. Merriam, president, Carnegie Institution.

J. Malcolm Muir, chairman, reforestation committee, Associated Advertising Clubs of the World.

Warren R. Roberts, chairman, general committee, standardization division, coal mining branch, American Mining Congress.

C. H. Sherrill, president, Sherrill Hardwood Lumber Co.

Henry W. Stokes, president, American Paper & Pulp Association.

E. H. Stoner, president, West Pennsylvania Lumber Co.

R. Y. Stuart, commissioner of forestry, Comonwealth of Pennsylvania.

W. B. Swift, assistant manager, purchasing department, International Harvester Co.

W. A. Thomas, president, Statesville Furniture Co.

Frank C. Wisner, president, National Lumber Manufacturers' Association.

Secretary Gore, Colonel Greeley, and Colonel Goodyear, the chairman of the committee, urged all members of the conference to give this committee any suggestions they had to make as to permanent organization and program.

On the afternoon of the second day of the conference the committee laid the following report before the conference:

STATEMENT OF THE PROBLEM

An adequate supply of timber is essential to the industrial development of the country and to the maintenance of present standards of living, as well as to the prosperity of the people and industries dependent upon the forests.

Regional timber shortages and consequent high costs are already making themselves felt to manufacturers and users alike, and will become increasingly serious during the many years needed to get an adequate program of timber growing into effect.

More careful utilization of forest products offers an immediate means of prolonging our supply of timber and should be recognized in the national program of forestry as of equal importance with timber growing and protection.

Knowledge of better utilization has outstripped practice, and should be applied wherever economically feasible, as a necessary measure to reduce the drain on the forests.

Through further research, understanding, and cooperation it will be possible still further progressively to reduce the drain on the forests.

Reducing needless drain will tend ot lower the cost of raw material, will create additional sources of profit from material now wasted, and will lengthen the life of plant investments by prolonging the supply of raw material.

The task of reducing these losses is a joint responsibility of the industrial, commercial, agricultural, governmental, educational, and professional interests, and the general public.

RECOMMENDATIONS AS TO PERMANENT ORGANIZATION

The purpose of the conference is to create means for introducing better practices in wood manufacture and use into general commercial application, and to stimulate the proper agencies to supply additional knowledge on better utilization. This can be accomplished only by the united efforts of manufacturers, distributors, consumers, farmers, educators, the press, the technical experts, and Government agencies for better forest utilization on a national scale. These efforts should be directed by a per-

manent organization which should be modeled on the following general lines:

1. It should be broad enough in its scope and application to coincide with the entire field of better utilization.

2. It should be sufficiently representative to give it standing with all groups who subscribe to the conference program.

3. A plan of turnover in representation will be needed so the burden will not fall on a few men permanently.

4. Financing to provide a secretary and other expenses will be necessary.

The central committee on lumber standards, which has carried on its work successfully in cooperation with the Department of Commerce and the Department of Agriculture, is representative of the lumber manufacturers, distributors, wood-using industries, architects, and engineers, and has acquired their confidence. Your committee recommends that the members of the central committee be asked to assume the responsibility of guidance of this movement for better utilization of forest products and elimination of waste, and for this purpose to function under the name of "The central committee on utilization of forest products," making such addition to its membership as it deems proper to carry out the purposes enumerated. For this work we recommend that the organizations represented in this conference and others equally interested be called upon to provide their proper share of the necessary annual budget.

RECOMMENDATIONS AS TO PROGRAM OF ACTIVITIES

A. Activities in which commercial application of available knowledge is the pressing need:

This group includes projects in which a large amount of information is already available and in which the chief effort of the permanent organization should be to get the information into commercial practice. The following projects of this nature are recommended:

1. Arrange for the completion and general adoption and application of lumber standards as recommended by the central committee on lumber standards.

2. Encourage a wider use of dimension stock by standardizing sizes to the lowest practical minimum.

3. Develop the application of scientific principles to the problems of piling, storing, and drying lumber, in all its forms.

4. Encourage the maximum service of wood by preservative treatments, in all situations where decay is a factor in its service.

5. Extend the further use of approved methods for preventing the decay of pulp and pulp wood in storage.

6. Give consideration to scientific methods for the arrest and prevention of decay in logs and lumber.

7. Encourage surveys with the objects of utilizing waste products through diversified operations.

8. Develop, improve, and unify building codes; improved designs of boxes and crates; and other economies that may suggest themselves to the committee.

9. Make effective the improvements and economies that have been developed in the use of forest products by getting together the organized industrial units which consume these products and encouraging their members to take full advantage of improved practices.

As an illustration of this suggestion, the mining industry has already developed improved practices for economizing in the use of forest products, and would welcome the cooperation of the permanent organization.

10. In all public construction—municipal, State, and national—insist upon the use of the improved practices which are herein recommended.

11. Collect all information that has already been developed by various organized units related to the use of wood and formulate a permanent plan for its distribution and application.

B. Activities in the research field:

Close utilization of timber and prevention of losses depend upon reliable knowledge obtained through investigation and experiment. A large amount of information has already been obtained through governmental and other research agencies. What has already been accomplished has demonstrated the great practical value of such information to the industries and in the conservation of our timber supplies. In spite of the progress that has been made, we still need investigations of a far-reaching character to secure the information needed to bring about the most economical use of our forest products. With the progressive depletion of the old supplies of timber and the necessary economic and industrial readjustment, the results of well-directed research will be increasingly required.

The lines of investigation which, in the opinion of the committee, require first consideration are the following:

1. *Woods losses.*—About one-fourth of our total annual forest drain is lost in the woods. Much of this loss can not be salvaged under present economic conditions, but provision should be made for a comprehensive investigation of the exact character of these losses and of all feasible possibilities of utilization. Such studies should include possible uses for tops, defective logs, limbs, and so-called inferior species; modifying logging methods that cause excessive breakage, and designing machinery for more efficient utilization. In this connection also freight rates on waste material should be studied.

2. *Sawmill waste.*—Intensive study of sawmill practice and machinery is also needed to determine more exactly the chief sources of waste and means of overcoming it.

3. *Little-used species.*—The practice of leaving in the woods timber of unpopular species bears heavily on the logger. The physical and mechanical properties of the so-called inferior species and the uses to which they are adapted should be determined. A systematic study of all species, whether or not "inferior," in order to find out their best uses, would permit a wiser utilization of our diminished supplies.

4. *Properties of wood.*—More fundamental knowledge of the properties and nature of wood will help greatly in improving utilization. Fundamental research, for example, on cellulose may lead to improved processes in pulp and paper making and in wood distillation and possibly to great extensions in the opportunities for closer utilization. Fundamental research on the physical structure of wood may throw new light on such processes as seasoning, preservative treatment, and steam-bending of wood. Accurate knowledge of the strength of wood is essential to best use in construction.

5. *Timber survey.*—More definite information should be available upon the following:

(*a*) The timber supply. How much timber of different species is available in saw timber and cordwood sizes, and where is it located?

(*b*) The amount of land available, by regions and classes of soil, upon which forests can be grown now and in the future.

(*c*) The rate at which timber is now growing and the potential growing capacity of the land.

A thoroughgoing timber survey will show the relation of the forest-using industries to their supply of raw material; it is essential as a basis for a comprehensive national forest policy.

6. *Wood-using industry survey.*—Very closely allied with a timber survey—in fact, a part of it—is a comprehensive survey of the requirements of the wood-using industries for forest products in relation to available and potential supplies. This can be secured only through a detailed study of the requirements of the individual industries and the wood-consuming public. The information should be in sufficient detail to determine accurately the species, grades, and amounts of timber necessary and the extent to which one species or grade can be substituted for others.

7. *Forest protection.*—It is of vital importance to continue and extend the investigations in respect to forest fires, insects, and tree diseases.

8. *Tropical woods.*—American wood users are looking to the possibility of using tropical woods to supplement certain of our high-grade hardwoods which are being rapidly depleted. Investigations are needed to determine the properties of tropical woods, their occurrence in the forest, and the problems of their exploitation, manufacture, and handling of the products.

A comprehensive program of research such as has been indicated requires the participation of Federal and State agencies, the forest schools and other technical institutions, and the forest industries. Certain investigations lie largely within the province of the Federal Government, such as the proposed timber survey, a national study of woods and sawmill waste, and laboratory studies which require large and expensive equipment. In these, however, cooperation by other public agencies and the industries is essential. Basic research and many local studies will, as heretofore, be conducted by educational and technical schools. The individual States should provide means to enable their forestry departments to conduct independent research and to cooperate with the Government. The industries can not only cooperate with the public quasi public research agencies, but, the committee believes, go much further than at present in research designed to meet their special problems.

The central committee on utilization of forest products can render a great service in stimulating interest

in research and can undoubtedly aid in securing greater support for research agencies. The committee will be in a position to point out to the research agencies the problems of special importance to the industries that need investigation; and can exercise great influence in bringing about a larger participation in active research work by the various industries.

A. C. Goodyear, *Chairman.*
A. R. Joyce, *Secretary.*
O. E. Bradfute.
O. M. Butler.
E. L. Carpenter.
Harry B. Curtin.
E. J. Curtis.
W. Z. Georgia.
Elliott H. Goodwin.
Henry S. Graves.
Charles H. Herty.
Elmer C. Hole.
John E. Lloyd.
B. F. Masters.
John C. Merriam.
J. Malcolm Muir.
Warren R. Roberts.
C. H. Sherrill.
Henry W. Stokes.
E. H. Stoner.
R. Y. Stuart.
W. B. Swift.
W. A. Thomas.
Frank C. Wisner.

DISCUSSION OF REPORT

Following the reading of the report, the chairman of the conference, Col. William B. Greeley, urged thorough discussion by members of the conference, saying that it was undesirable to adopt a plan of such importance in a perfunctory manner. The discussion that ensued is only briefly quoted in the following pages:

David L. Goodwillie (chairman, committee on national forestry policy, Chamber of Commerce of the United States). After quite an exhaustive investigation of forestry conditions in the United States, the committee found one fact that stood out very, very strongly in their minds, and that is that the lumbermen have been falsely accused of being wasters. They are meeting the same conditions that you and I are in business, whether in coal or oil or whatever it may be. Unfortunately, competition has forced us to do things that to the public looked like waste, but were in truth economic savings.

My only regret in this convention is that one of the sessions could not be given up to the utilization of our waste land, as well as the utilization of timber. The President made two remarks in this connection in his address yesterday that I want to take the liberty of quoting. He said:

> Much of our cut-over land, lying idle or half productive, is now an immeasurable loss.

We have 5,000,000 acres of such land in the State of Illinois, and in a State that used to be 40 per cent a timber-growing State. The President went on to say:

> It pays little or no taxes, it keeps few hands busy, it turns few wheels, it builds no roads. Idle forest land has scrapped schools, factories, railroads, and towns; it has dotted the land with abandoned farms; it has created a migratory population.

Let me give you another quotation from his concluding statement:

> We hold the resources of our country as a trust. They ought to be used for the benefit of the present generation, but they ought neither to be wasted nor destroyed. The generations to come also have a vested interest in them. They ought to be administered for the benefit of the public.

I want to tell you, the President has brought home to us some truths well worth thinking about. I hope that in the work of the central committee a program of education will be thought out and worked out so well that no other committee will be needed to cover the same ground again.

Hon. John D. Clarke (Member of Congress from New York and coauthor of the Clarke-McNary Act). When Colonel Greeley warned me just before luncheon that I might be called on for a few remarks this afternoon, the thought occurred to me that possibly I could bring to you a sort of picture of the evolution of what we now call the Clarke-McNary bill. You will recall the efforts that have been made all over the United States to direct the public intelligence toward the establishment of a national reforestation policy. Three bills were under consideration; months of time was given to them, and we were getting nowhere, because those bills were trying to legislate us into the millenium by the short-cut route. We all know that the only way to get into heaven is to work out our own salvation, and let the lunatic fringe go its own way, pointing to the great thing that we hope to bring about. Finally, when we could not get the Snell bill through, and we had all these various factions working here at cross purposes, Colonel Greeley, Secretary Wallace, and a few of us used to get together at the University Club to whit-

tle out points and principles. I dug out to-day that little thing that in those days I shaped into a national recipe, and I want to read it to you because it incorporates exactly the principles of the Clarke-McNary bill:

Take 96 United States Senators and 435 Members of Congress. Mix well with pictures of the denuded hills of China and its population with the lowest standards of living. Add a panoramic view of our now fast-disappearing forests, due to the absence of a national forest policy. Place into this mixture the leaven of an aroused public conscience, demanding a national forest policy adequate to the requirements of the United States. Knead into six loaves, embodying the following points based on reciprocal laws and the cooperation of each of the States with the Federal Government:

1. More funds for patrol and lookout stations to prevent and put out forest fires.

2. Just forest taxation laws to encourage private owners to grow trees.

3. Substantial additions to the already existing areas of public-owned forest lands.

4. More assistance to the private forest owner, both in aiding reforestation and in the proper management of existing woodland.

5. Adequate appropriation for investigation and research work in order to utilize and standardize and get the most out of our forests.

6. Permission for owners of private forest land who actively cooperate with the Government to deduct a certain percentage from their income-tax returns, the same principle as is now followed where the individual makes charitable contributions.

Repeat the process with the legislatures in each of the 48 States. Bake quickly.

Result, 48 States cooperating with the National Government, and the citizens of all the to-morrows singing the praises of all those who joined in accomplishing this long-desired end.

John Foley (forester, Pennsylvania system). I wish to congratulate the committee on having in such a short period accomplished this very complete and concise report. It goes without question that the generalities in which the report is bound to deal need to be worked out in detail, and I am sure the convention, has found in the central committee an organization that is quite capable of carrying on this project.

Ernest Boley (American Steel & Wire Co.) compared the conditions in China and the United States, countries having no definite forest conservation policy, with the conditions in European countries, where forests are regarded as crops to be harvested.

William A. Babbitt (secretary, National Association of Wood Turners). A large part of my correspondence is taken up with letters from manufacturers of lumber who wish to advise me that they have decided to enter the dimension stock game, and reveal the fact that they know very little about what they are getting into. I know of more than one operation in bad shape because it has gone into this thing without realizing the difference between making and marketing dimension stock and making and marketing standard lumber.

W. L. Sykes (president, Grasse River Railroad Corporation, Conifer, N. Y.). This last talk brings me to my feet because the dimension business is not new to me. I can go back 40 years, when I began to get into the sawmill business, and a good portion of my business was dimension stock at that time. The log run product cost too much delivered in the west branch of the Susquehanna Valley, so we kept hundreds of thousands of feet of dimension stock for bedposts at that early date.

A great deal has been said about producing so many cubic feet per year to take the place of the diminishing forests, but very little has been said about the relative value and the relative need for the large-sized timber of the old-growth forests, as compared with small trees of the new crop coming in. We shall have to build beautiful homes and large buildings like this, with lumber not anywhere equal to what we are putting in these buildings to-day. You need not be a forester or lumberman to know that you can not make a piece of furniture like that over there, or like the furniture in any of the buildings or the homes in Washington to-day, out of a tree only 50 years of age. Nowadays we call a 50-year tree a sapling, and people to-day would call a tree 100 years old a sapling, when it comes to getting clear lumber free from defects.

We have a law against combinations in restraint of trade. As a matter of conservation, lumbermen ought to be a favored class, so that we could get together to the extent of raising the price on high-grade lumber.

High-grade lumber should bring a higher price, and low-grade lumber should bring a price that would make its conservation possible; and in return we should be compelled to put a good percentage back in reforesting our lands on that yield taxation proposition, and then we would all be busy raising forests.

Dr. Joseph Hyde Pratt (president, Western North Carolina [Inc.]). I have one suggestion relative to the report on the program of activities. We all know of the good work the committee on lumber standards has done. We know that unless the men gathered here get behind that committee and assist them, they will not accomplish what our committee has requested of them. Now, they have the authority under this report to make additions to their committee, taking up other lines of thought in the lumber and forestry work. Perhaps the main part of the report is that containing the idea of getting together the organized industrial units which consume forest products and encouraging their members to take full advantage of improved practices. We are putting a big work on the central committee. If we vote to-day to adopt this report, and it is voted unanimously, that ought to carry to the central committee that everybody in this meeting is backing the committee, not only in advice and suggestions, but also in financial support if necessary to help the committee carry on that work.

John H. Kirby (president, Kirby Lumber Co.). The central committee, as you all know, has been quite active for the past two and a third years. During that period it has expended $18,000, of which $4,167 is not yet paid. So you are selecting an insolvent concern when you pass these resolutions, unless some provision is made for furnishing funds to cover the expenditures of the committee. It is our thought that a fund of at least $25,000 per year ought to be provided.

Under the regulations which the committee adopted for its government, it is provided that national associations interested in this work may become members of this activity by contributing to its support $500 per year; regional associations, not members of any national association, $250 per year; regional associations desiring to make an individual contribution in addition to that made by the national to which it belongs, $150 per year; clubs and other organizations, local associations, $100 per year. In addition to that, in order to supply the deficit in the revenue raised in that manner, the associations are expected to contribute such sum, not exceeding 3 per cent of their annual revenue, as may be necessary to cover the deficit.

You gentlemen, in passing the duty to this committee of carrying on this great work, must do so with the deliberate intention of providing some means of accomplishing the end. No member of the committee is on salary, and our disbursements are for clerical help, for printing bills, and other things incidental to the work we have been carrying on. The Department of Commerce has generously furnished us with a convenient hall when we had meetings of men interested in this work. We have had the very finest cooperation and assistance from the Department of Commerce and from the Department of Agriculture. We will doubtless have that in the future, but in order to put this great thought over, in order to bring about perfect standards in the manufacture of lumber, in order to eliminate waste in the distribution of lumber, in order to accomplish the things for which this conference was called, it is necessary to have the complete accord and cooperation both intellectually and financially of every end of the industry, from the landowner, the tree owner, to the last user of the forest product.

It will not take a large sum of money, but it is a necessary sum of money if you are going to attain the end you seek. I have been identified with this work from its beginning; I have been the least of the factors that have cooperated to obtain the fine success we have obtained up to this time. I am not talking for myself; I am talking for the success of your committee. I want to impress upon you that there is an equitable way for raising this fund. I do not expect all of you to run your hand in your pocket just this minute; but when you get back to your homes and your organizations, you will see to it that your town is not forgotten.

J. H. Allen (president, Sterling Lumber Co.). We have come here to consider saving billions of feet of timber, and say that it takes $18,000 a year to do the business. It takes money to save billions of feet of timber; it takes more than an $18,000 idea. Another thing—this stuff must be made practical, so that the lumbermen will not have to write in to find

what machines they should have, and so on. I think the committee should give some thought to attaching these theories to practical affairs, and in all their calculations not forget the small sawmill man. Get some money and make it practical; and I suggest that the Government, the States, the universities, and the industries be called upon. You might need two or three million dollars.

One of the troubles with the dimension stock business all through the past years, and at the present time, is that the consumer wants to buy a perfectly clear piece of wood, without any defect, for a less price than he will have to pay for the No. 1 or 2 grade from which he would cut it in his own factory. That has always been the case, and yet the cost of producing this stuff has increased greatly, particularly since the war. Wages are so high, the cost of producing is so high, and the loss so great when you kiln-dry dimension stock, that the amount you get paid for it finally should bring as much as the No. 1 or 2 grades, or there is no incentive to do the business.

(Justiniano Baca (Commissioner of public lands, New Mexico) assured the conference of the interest of New Mexico, with her several hundred thousand acres of forest land, in the work of the Permanent Committee, and stated his belief that the financing of their work should be in some measure supported by the different States of the Union having forestry interests. In such a program New Mexico would be glad to cooperate, he said.)

W. A. Guthrie (State department of conservation, Indiana). The great thing in which I am interested is what Mr. Goodwillie, of Chicago, suggested—that we should care for our waste land. In Indiana we have 2,300,000 acres not producing anything at this time. We want reforestation. We are going to work in cooperation with the Federal Government under the Clarke-McNary bill.

(H. B. Berry (Fort Plain, N. Y.) urged a law regulating the cutting and sale of Christmas trees, so that this practice might be coordinated with good forestry practice, rather than, as now in many instances, to be a source of loss and waste.)

(There being no further discussion, the report of the temporary committee on permanent organization and program was voted on and unanimously adopted by the conference.)

(A motion was also made and carried that the temporary committee continue in existence to cooperate with the central committee until that cooperation should no longer be needed.)

(Acting Secretary Gore addressed a few words of appreciation and farewell to the conference, characterizing its work in striving to settle an important peace-time problem as a form of patriotism comparable to that displayed in time of war.)

Colonel Greeley. In adjourning this conference, let me express my deep appreciation for your help and service. It has been a wonderful thing from the Government end to have this indication of your interest and your help.

PARTICIPATING ORGANIZATIONS

Agricultural Publishers Association.
American Association of Advertising Agencies.
American Association of Engineers.
American Association of Paper Specialty Manufacturers.
American Chemical Society.
American Electric Railway Association.
American Electric Railway Engineering Association.
American Engineering Council.
American Engineering Standards Committee.
American Farm Bureau Federation.
American Forestry Association.
American Institute of Architects.
American Institute of Chemical Engineers.
American Institute of Consulting Engineers.
American Institute of Electrical Engineers.
American Institute of Mining and Metallurgical Engineers.
American Institute of Park Executives.
American Legion.
American Mining Congress.
American Nature Association.
American Newspaper Publishers' Association.
American Paper and Pulp Association.
American Railway Association.
American Railway Engineering Association.
American Society of Agricultural Engineers.
American Society of Civil Engineers.
American Society of Mechanical Engineers.
American Society for Testing Materials.
American Tree Association.
American Walnut Manufacturers' Association.
American Wood Preservers Association.
Appalachian Logging Congress.
Associated Advertising Clubs of the World.
Associated Cooperage Industries of America.
Associated General Contractors of America.
Association of Railway Executives.
Association of Wood Using Industries.
Better Homes in America.
Boston Chamber of Commerce.
Box Board Manufacturers' Association.
Boy Scouts of America.
California Forest Protective Association.
California Redwood Association.
California White and Sugar Pine Manufacturers' Association.
Camp Fire Club of America.
Central Committee on Lumber Standards.
Chamber of Commerce of the United States.
Concatenated Order of Hoo-Hoo.

Converting Paper Mills Association.
Cost Association of the Paper Industry.
Cover Paper Manufacturers' Association.
Engineering Foundation of New York.
Florida Forestry Association.
Folding Box Manufacturers' National Association.
Forest Products Association.
Georgia Forestry Association.
Georgia-Florida Sawmill Association.
Hardwood Consulting Committee of the Central Committee on Lumber Standards.
Hardwood Manufacturers' Institute.
Isaak Walton Leagues.
Kiwanis International.
Manufacturing Chemists' Association of the United States.
Massachusetts Forestry Association.
Miami Valley Paper Association.
Millwork Cost Bureau.
Minnesota Federation of Architects and Engineers.
Missouri Forestry Association.
Montana Joint Forestry Committee.
Music Industries Chamber of Commerce.
National Academy of Sciences.
National Alliance of Furniture Manufacturers.
National-American Wholesale Lumber Association.
National Association of Box Manufacturers.
National Association of Chair Manufacturers.
National Association of Farm Equipment Manufacturers.
National Association of Purchasing Agents.
National Association of Railroad Tie Producers.
National Association of Wood Turners.
National Automobile Chamber of Commerce.
National Board of Farm Organizations.
National Board of Fire Underwriters.
National Canners' Association.
National Coal Association.
National Commercial Fixture Manufacturers' Association.
National Container Association.
National Council of Furniture Associations.
National Editorial Association.
National Fire Protection Association.
National Hardwood Lumber Association.
National League of Women Voters.
National Lumber Manufacturers' Association.
National Lumber Manufacturers' Interinsurance Exchange.
National Piano Manufacturers' Association of America.
National Research Council.
National Retail Lumber Dealers' Association.
National Varnish Manufacturers' Association.
National Veneer and Panel Manufacturers' Association.
National Wood Chemical Association.
News Print Service Bureau.
New York State Forestry Commission.
Norfolk-Portsmouth Chamber of Commerce.
North Carolina Pine Association.
Northeastern Retail Lumbermen's Association.
Northern Hemlock and Hardwood Manufacturers' Association.
Northern Pine Manufacturers' Association.
Northern White Cedar Association.
Northwestern Lumbermen's Association.
Northwestern Retail Lumbermen's Association.
Oportunists International.
Pan American Union.
Plywood Manufacturers' Association.
Portland (Oreg.) Chamber of Commerce.
Railway Car Manufacturers' Association.
Railway Fire Protection Association.
Rotary International.
Save the Surface Campaign.
Society for Protection of New Hampshire Forests.
Society of American Foresters.
Society of Automotive Engineers.
Southern Cypress Manufacturers' Association.
Southern Furniture Manufacturers' Association.
Southern Hardwood Traffic Association.
Southern Pine Association.
Synthetic Organic Chemical Manufacturers' Association.
Technical Association of the Pulp and Paper Industry.
Texas Forestry Association.
Tissue Paper Manufacturers' Association.
Toy Manufacturers' of the United States of America.
Turpentine and Rosin Producers' Association.
Virginia Federation of Women's Clubs.
West Coast Forest Products Bureau.
West Coast Lumbermen's Association.
Western Forestry and Conservation Association.
Western North Carolina (Inc.).
Western Pine Manufacturers' Association.
Western Society of Engineers.
Wholesale Sash and Door Association.
Wirebound Box Manufacturers' Association.
Wrapping Paper Manufacturers' Service Bureau.
Writing Paper Manufacturers' Association.

DELEGATES

[*Present at the chief business session Thursday afternoon, Nov. 20.]

Agnew, P. C., secretary, America Engineering Standards Commission, New York.
*Ahern, Col. Geo. P., 1438 Belmont Street, Washington, D. C.
Allen, C. B., Geo. G. Roverts Manufacturing Co., Chicago, Ill.
Allen, E. M., president, Holston River Lumber Co., Darlington, Md.
*Allen, E. P., National Lumber Manufacturers' Association, Washington, D. C.
*Allen, J. H., president, Sterling Lumber Co., St. Louis, Mo.
*Allen, R. B., secretary, West Coast Lumberman's Association, Seattle, Wash.
*Allen, S. W., American Forestry Association, Washington, D. C.
*Anderson, C. F., Anderson Lumber Corporation, Marion, S. C.
*Anderson, G. A., B. K. Settergreen Co., Bluffton, Ind.
*Andrews, Howard, Nashville, Lumber Co., Nashville, Tenn.
*Apperson, S. S., American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York City.
*Atkins, H. C., president, E. C. Atkins & Co., Indianapolis, Ind.
*Atwood, Col. Wm. G., 50 Church Street, New York City.
*Ayers, Philip W., secretary, Society for Protection of New Hampshire Forests, Boston, Mass.

*Babbitt, Wm. A., secretary, National Association of Wood Turners, South Bend, Ind.
*Babcock, A. T., Western Maryland Railway Co., Baltimore, Md.
Babcock, E. V., Babcock Lumber Co., Pittsburgh, Pa.

*Baca, Justinano, Land Commissioner of New Mexico, Santa Fe, N. Mex.
*Badeaux, Wm. H., secretary, Northwestern Lumbermen's Association, Minneapolis, Minn.
Bain, H. Foster, Director, Bureau of Mines, Washington, D. C.
Baker, H. P., secretary, American Pulp and Paper Association, New York City.
Baker, Wm. B., secretary, National Association of Chair Manufacturers, Chicago, Ill.
*Baker, Willis M., Department of Conservation Development, Trenton, N. J.
*Baldwin, Mrs. Harris T., National League of Women Voters, Washington, D. C.
Ballard, C. M., Forest Service, Washington, D. C.
*Bancker, W. F., general purchasing agent, Western Electric Co., New York City.
Barnett, W. L. E., president, Florida Forestry Association, Mount Dora, Fla.
Barrett, C. S., Farmers' Union, Union City, Ga.
*Beals, W. B., Chesapeake & Potomac Telephone Co., 725 Thirteenth Street NW., Washington, D. C.
Beard, Daniel C., National Scout Commissioner, Flushing, N. Y.
*Behrens, H. C., Northwestern Lumbermen's Association, Aberdeen, S. Dak.
*Belcher, R. S. Mgr., treating plant, Atchison, Topeka & Santa Fe Railroad, Topeka, Kans.
*Bell, Landon, C., Columbus, Ohio.
Bennett, W. S., Edward Hines Lumber Co., Chicago, Ill.
*Benson, A. O., Forest Products Laboratory, Madison, Wis.
*Bent, L. N., Hercules Powder Co., Wilmington, Del.
*Berry, H. V., Fort Plain, N. Y.
*Besley, F. W., State forester, Baltimore, Md.
*Betts, H. S. United States Forest Service, Washington, D. C.
*Bickelhaupt, F. J., Studebaker Corporation, South Bend, Ind.
Bien, Morris, vice president, American Association of Engineers, Washington, D. C.
*Bigelow, C. A., president, Bigelow Cooper Co., Bay City, Mich.
*Bishopric, Allison, Bishopric Manufacturing Co., Cincinnati, Ohio.
Bissell, M. K., Erickson & Bissell, Escanaba, Mich.
*Blatchvord, J. W., Southern Wood Preserving Co., Atlanta, Ga.
*Blodgett, John W., chairman, central committee on lumber standards, Grand Rapids, Mich.
Boffey, L. F., editor, Purchasing Agent, New York City.
*Bond, Francis M., Norfolk-Portsmouth Chamber of Commerce, Norfolk, Va.
Boocock, Mr. and Mrs. Murray, Castalia, Keswick, Va.
*Boyce, C. W., Forest Service, Washington, D. C.
*Boyd, Geo. E., Railway Review, 537 South Dearborn Street, Chicago, Ill.
Bradfute, Oscar E., president, American Farm Bureau Federation, Chicago, Ill.
Breece, Col. Geo. E., president, Geo. E. Breece Co., Albuquerque, N. Mex.
Brewster, Donald R., dry kiln consultant, Cincinnati, Ohio.
*Briscoe, J .M., dean, department of forestry, University of Maine, Orono, Me.
Brokaw, W. H., director, agricultural extension work, Lincoln, Nebr.
Bromley, W. F., Hammermill Paper Co., Erie, Pa.
Brosseau, A. J., president, Mack Trucks (Inc.), New York City.
Brown, Elmer E., president, New York University, New York City.
*Brown, James Wright, editor, Editor & Publisher, New York City.
*Brown Nelson C., New York State College of Forestry, Syracuse, N. Y.
Brown, R. E., Society of Automotive Engineers, Detroit, Mich.
*Browne, Junius, president, Pacific Lumber Co., of Illinois, New York City.
*Browning, Prof. H. W., Rhode Island State College, Kingston, R. I.
Bruce, Robert, E. L. Bruce Co., Memphis, Tenn.
*Brush, W. D., Forest Service, Washington, D. C.
*Bryant, Dr. R. C., Yale Forest School, New Haven, Conn.
*Bucklew, L. L., manager, Carter Bloxonend Flooring Co., Cleveland, Ohio.
Buell, Guy L., president, Montgomery Lumber Co., Spring Hope, N. C.
Burgess, Richard F., El Paso, Tex.
Burgess, Dr. Geo. K., director, Bureau of Standards, Washington, D. C.
Burton, Henry C., Chicago University, Chicago, Ill.
*Bury, R. A., tie agent, Michigan Central Railroad, Detroit, Mich.
Bush, H. O., Erie Railroad Co. (Address unknown.)
*Butler, Morton, Chicago, Ill.
*Butler, O. M., executive secretary, American Forestry Association, Washington, D. C.

Callbreath, James F., American Mining Congress, Washington, D. C.
Cameron, A., Princeton, N. J.
*Cameron, Mr. and Mrs. J., Washington, D. C.
Carpenter, E. L., president, Shevlin, Carpenter & Clark Co., Minneapolis, Minn.
Cashman, James E., Burlington, Vt.
Chadwick, Charles S., president, Eppinger & Russell Co., New York City.
*Chandler, B. A., Bureau of Internal Revenue, 112 Chestnut Avenue, Tacoma Park, Washington, D. C.
*Chandler, W. L., secretary, National Association of Purchasing Agents, New York City.
Chapin, Roy D., Hudson Motor Car Co., Detroit, Mich.
*Chapler, R. H., Western Forestry and Conservation Association, Portland, Oreg.
*Cheney, C. M., Diamond Match Co., 30 Church Street, New York City.
Cherry, G. J., president, North State Lumber Co., Charleston, S. C.
*Chittenden, A. K., Michigan Agricultural College, East Lansing, Mich.
*Church, S. R., research department, The Barrett Co., New York City.
Church, W. A. H., president, W. A. H. Church Co., Washington, D. C.
Clapp, A. W., St. Paul, Minn.
*Clapp, E. H., United States chief branch of research, Forest Service, Washington, D. C.
Clark, Frederick, Hawthorne Paper Co., Kalamazoo, Mich.
*Clark, Harry B., National Lumber Manufacturers' Interinsurance Exchange, Chicago, Ill.
*Clark, Congressman John D., Fraser, N. Y.
*Clark, T. H., tie and timber agent, Southern Railway, Washington, D. C.
Clark, V. L., Des Moines Sawmill Co., Des Moines, Iowa.
Clark, W. A., chief engineer, Duluth & Iron Range Railway, Duluth, Minn.
*Clark, Wm. C., Columbia University, New York City.
Clark, Dr. Wm. O., Tenafly, N. J.

Clifford, J. W., Washington, D. C.
Cobbs, John L., jr., secretary North Carolina Forestry Association, Wilmington, N. C.
Coffey, W. C., University of Minnesota, St. Paul, Minn.
Coffin, A. D., C. H. Dexter & Sons (Inc.), Windsor Locks, Conn.
*Cogswell, Robt. F., Lumber Trade Journal, New Orleans, La.
Coker, J. L., Hartsville, S. C.
*Colley, R. H., Bureau of Plant Industry, Madison branch, Madison, Wis.
*Collier, J. C., Carr, Ryder & Adams Co., Dubuque, Iowa.
Collier, Paul S., secretary, Northeastern Retail Lumbermen's Association, Rochester, N. Y.
Collins, Grellett, N., Dill & Collins Co., Philadelphia, Pa.
*Collins, Harold B., Dill & Collins Co., Philadelphia, Pa.
*Compton, Wilson, secretary, National Lumber Manufacturers' Association, Washington, D. C.
Concannon, C. C., Department of Commerce, Washington, D. C.
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*Uhl, Harry G., secretary, Central Committee on Lumber Standards, Washington, D. C.

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Von Schrenk, Dr. Herman, consulting timber engineer, St. Louis, Mo.
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*White, Wm. H., president, W. H. White Co., Boyne City, Mich.
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Willys, John N., president, Willys-Overland Co., Toledo, Ohio.
*Wilson, Ellwood, Laurentide Co. (Ltd.), Grand Mere, Province of Quebec, Canada.
Wilson, J. F., Cloquet, Minn.
Wilson, N. W., vice president, Hammermill Paper Co., Erie, Pa.
Wilson, W. P., Wheeling, W. Va.
*Williams, L. K., Patterson, La.
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WOOD WASTE PREVENTION

A digest of the problem before the National Conference on Utilization of Forest Products

By ROLF THELEN

Engineer in Forest Products, Forest Products Laboratory

OUR WOOD-USING INDUSTRIES ARE FACING EXHAUSTION OF RAW MATERIAL

Wood is the raw material for a group of American industries which ranks approximately third in value of output among all the groups supporting the Nation's economic life.

Only agriculture is clearly and unmistakably more important than the industries which depend on wood for their existence.

The existence of these industries is now threatened by a growing shortage of wood.

An adequate supply of timber is essential to the proper housing of our population and to industrial development. Wood substitutes have multiplied, but no faster than wood uses. Wood shortage therefore means a lowered standard of living and a tremendously costly scrapping of plants and readjustment of industries. To avert it is a national problem of the first magnitude.

The outlines of that problem are here set forth, to show how a closer utilization of forests constitutes one of the three necessary steps toward its solution.

OUR PRESENT TIMBER SUPPLY IS ONE-THIRD OF ORIGINAL STAND

The present area of forest land in the United States is approximately 469,500,000 acres.

This is about 57 per cent of the original forest area, but it has been largely cut and burned over, so that it now bears less than one-third of the country's original forest stand. It consists principally of land better suited to the growth of forests than to agriculture. It includes a variety of types, ranging from chaparral to

giant redwoods. Some of it bears virgin timber which has never been touched by the ax; some is cut-over forest which is producing second growth; some is cut-over and burned-over land which has become barren and useless. The proportions are about as follows:

	Acres	
Virgin forest		138,100,000
Cut-over and burned-over forest:		
Second growth, saw-timber size	113,800,000	
Second growth, cordwood size	136,400,000	
Nonrestocking	81,200,000	
		331,400,000
Total		469,500,000

The total supply of forest material is divided, for convenience, into saw timber and cordwood. Saw timber includes everything large enough to produce sawed stock such as lumber, railroad ties, and dimension material, under the logging and milling practices current in the different regions, and also round stock such as poles, piling, and mine timbers. Cordwood includes all material, under the logging and milling practices current in the different regions, and also round stock such as poles, piling, and mine timbers. Cordwood includes all material too small for saw timber.

In expressing amounts, whether of saw timber or of cordwood, the present report arbitrarily assumes as a common denominator a cubic foot of standing timber, which includes the

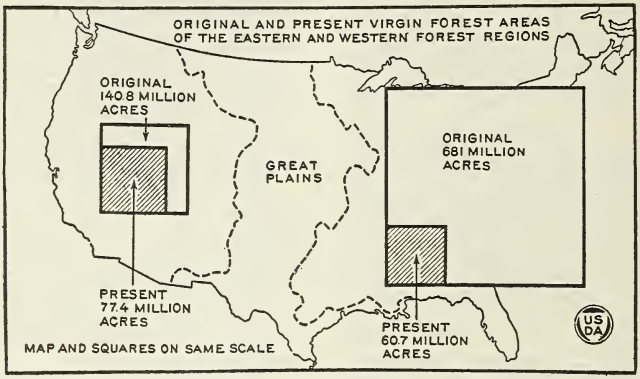

FIG. 6.—Only a remnant of the original Eastern forest remains, and nearly half of the virgin forests of the West have gone

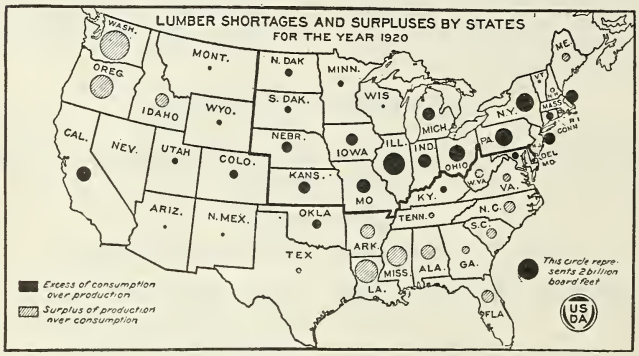

FIG. 7.—The States having black circles must haul in wood to meet their needs. The States north and east of the heavy line, in our greatest industrial and food producing region, must pay a heavy freight bill on 75 per cent of the lumber they use
A practical and immediate means of reducing this freight bill is to cut the manufactured products needed from a smaller amount of lumber, which can be done by reducing waste.

merchantable portion of the tree, the stump, and the top, all with bark, but excluding limbs and branches.

The total remaining stand of timber is, according to this assumption, estimated as follows:

	Billion cu. ft.
Saw timber	485
Cordwood	261
Total	746

In addition to this drain of 22.4 billion cubic feet, there is a waste in the forest itself, from fire, decay, insect attack, and windfall, of about 2.4 billion cubic feet. (As to fire, this figure does not include the wastage of reproduction, which can not be measured in cubic feet.)

It is obvious that if the present rate of drain were to continue unrelieved, and if there were no growth increment, the Nation's entire stand of timber would be wiped out in a comparatively few years—the saw timber in about 37½ years, and the cordwood in about 22 years.

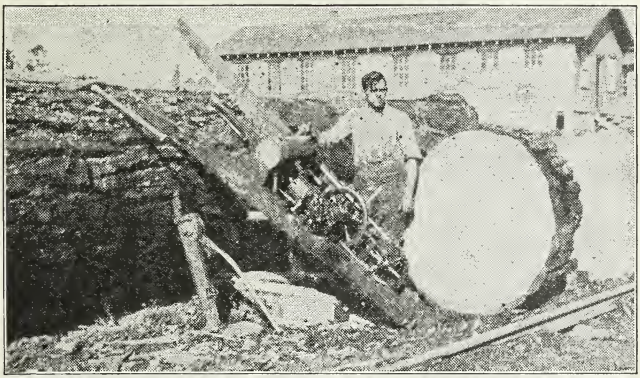

FIG. 8.—Cutting this log into stovewood at a lumber camp typifies the low value placed on logs in forests far from consuming centers and the difficulty of conserving wood for its highest use

TIMBER SHORTAGE WILL BECOME GENERAL IN A FEW YEARS

The present rate of cutting from our forests is about as follows:

	Billion cu. ft. per annum
Saw timber	11.6
Cordwood	10.8
Total	22.4

The rate of drain is not likely to decrease; in fact, economic studies point to the conclusion that, although our per capita consumption of wood is declining, our wood requirements will

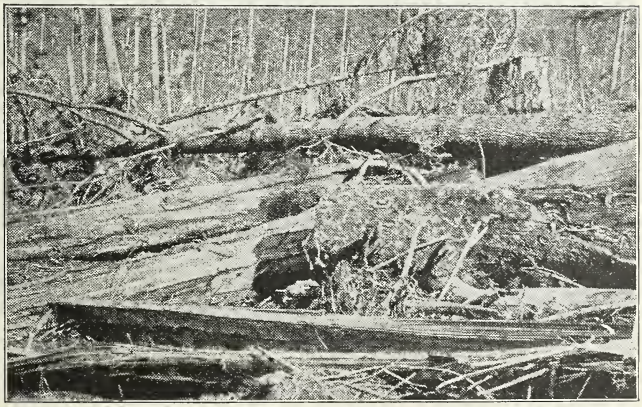

FIG. 9.—At the same time the big log shown in the upper photograph was being fed into the cookhouse range, the woods all about the camp were filled with a tangle of broken spruce and hemlock, part of the 2.3 billion cubic feet of wood wasted yearly in logging

increase from year to year with the increase in population.

The increment of wood through growth is 6 billion cubic feet a year.

ber and cordwood, unless lost by fire or premature cutting.

Still the central fact is that we are using up our timber four times as fast

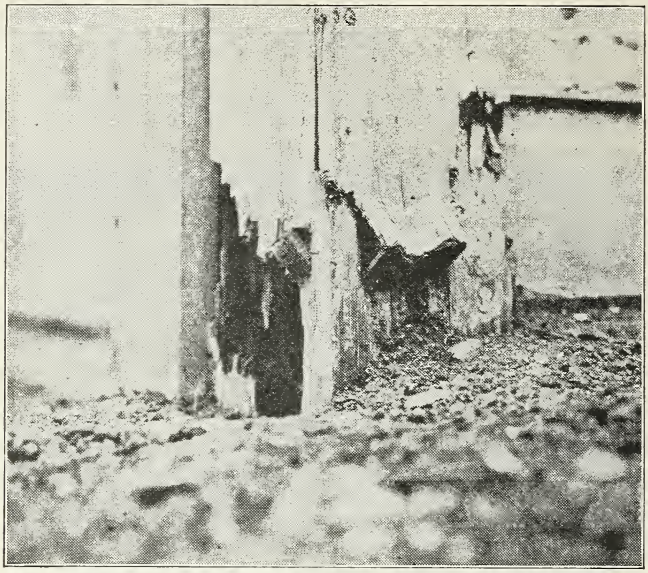

FIG. 10.—This is a frame building corner post set directly in the soil without preservative treatment. About 15 per cent of the annual production of lumber and dimension material goes to replace wood destroyed by decay in service

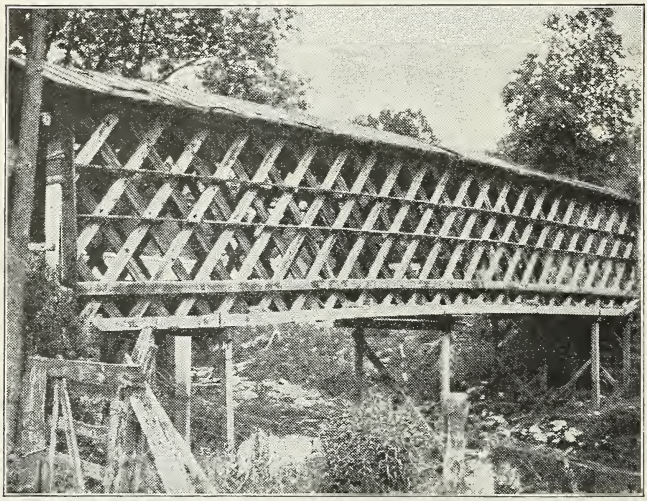

FIG. 11.—Excesses in the use of timber in structural design no longer exist to the degree that they did when this old highway bridge was built, but the use of accurate strength data for wood still offers an opportunity for saving structural timber

Although this growth is mostly on trees now in the cordwood class, it will have its effect eventually in extending the supplies of both saw timber as it grows, and the end of more than three centuries of abundance is now plainly in sight.

BETTER UTILIZATION IS AN IMMEDIATE RECOURSE

The object of a constructive forest policy is to supply enough timber and other forest products to meet the Nation's needs. Only three lines of action are possible to meet the situation:

FIG. 12.—Fully half of the annual production of railroad ties is used to replace ties decayed in service. Less than half of all ties installed are now treated with preservatives. The possible saving of wood by this practice is enormous

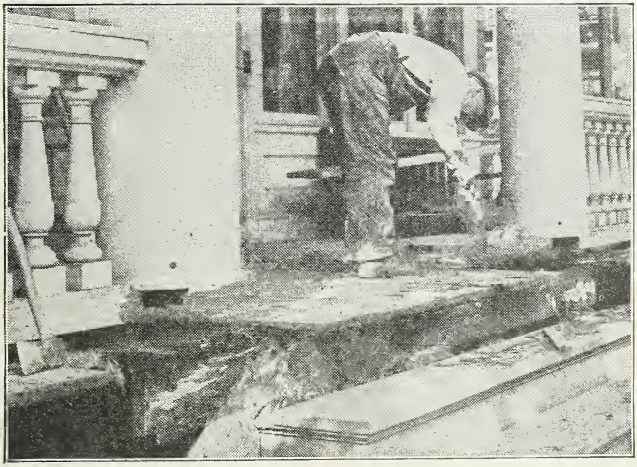

FIG. 13.—Fifteen per cent of all the lumber manufactured goes each year to replace wood that has decayed in service. Architect, contractor, and lumber dealer can cooperate to reduce such losses

(1) Promoting forest growth.

(2) Promoting forest protection, principally from fire.

(3) Promoting less wasteful manufacture and use of forest products.

While it is essential to promote in every way possible the growing of forests, it is evident from the foregoing figures that the existing stands will be exhausted before a new crop of saw timber can be matured.

It is likewise essential that adequate fire protection be provided for all of the Nation's forests, not only

to save the mature timber, but also to protect the young timber now maturing and the reproduction which will be saw timber 75 or 100 years hence; also to safeguard the fertility of the soil for future forests. The volume of standing timber annually destroyed by fires is probably between one-half billion and one billion cubic feet. (The figure inadequately represents the loss, for the reason that young timber does not show a big volume in cubic feet.) This fire toll, if saved and made available yearly, would of course serve to extend our timber supply, but not enough to avert the impending shortage.

More effective methods of manufacture and use of forest products hold out the best hope for immediate aid in the alleviation of the timber shortage. Improvements can be made immediately on the basis of knowledge already available. Present wastes and losses are enormous. Present average practice in manufacture and use of forest products is so far below present best practice that tremendous savings can be made at once.

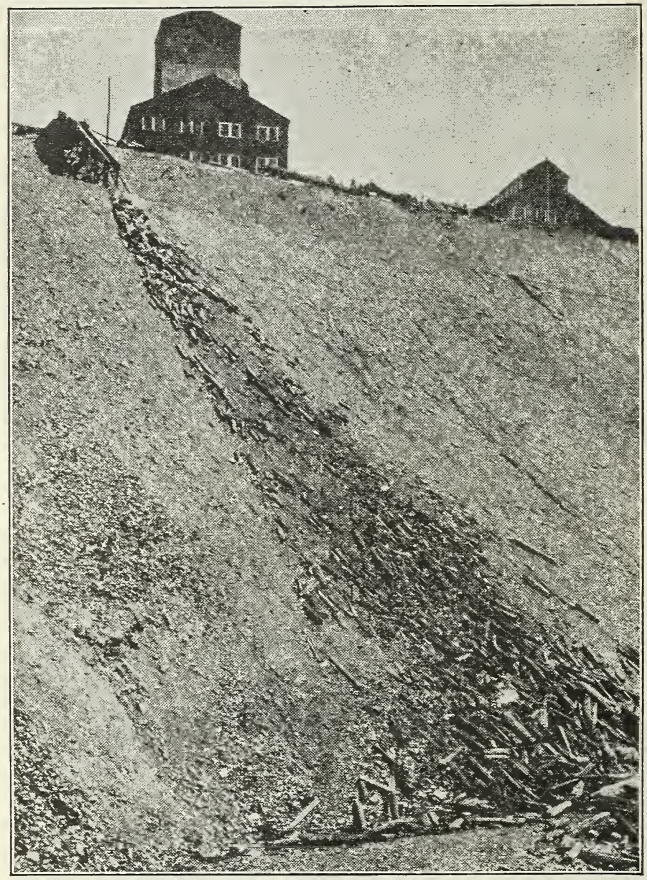

FIG. 14.—Because of failure through decay there are thrown on the dump heap each year 79,000,000 cubic feet of mine timbers, the equivalent of the annual growth on a million and a half acres of land. Two-thirds of this loss is economically preventable through preservative treatment

If present best practice and knowledge were put into effect to the fullest extent economically feasible, it is estimated that a saving of approximately two-ninths of the present drain on the forests could be accomplished.

The reader should note carefully that the estimated saving of two-ninths the annual drain is based entirely upon economies already proved to be feasible. Further economies of at least

equal magnitude will almost certainly be developed through research, making possible a total saving of four-ninths of the annual drain and a corresponding extension of the existing timber supply. It thus appears that better utilization will help to bridge the gap between the exhaustion of virgin stumpage and the availability of new forests.

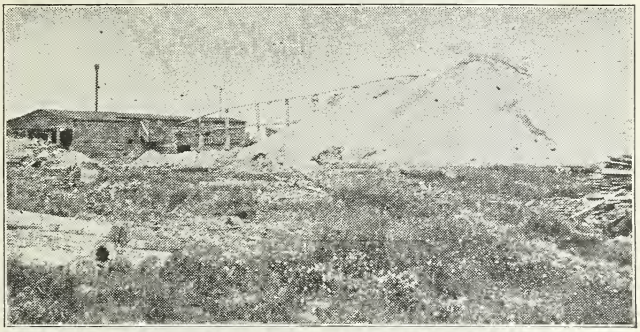

FIG. 15.—At the mill shown here about one log in five goes to the sawdust pile because wide-gauge circular head saws are used. The circular head saws used for cutting about 42 per cent of our total production of sawed material waste every year, in excess saw kerf, an amount of wood equivalent to two-thirds billion cubic feet of standing timber over and above that which would have been wasted had band saws been used

AN EXAMPLE OF HOW GOOD UTILIZATION REDUCES DRAIN ON THE FOREST

Assume a railroad track a mile long. In its construction 2,640 wooden crossties are required. (No satisfactory substitute has as yet been found for the wooden tie.)

Suppose that we use a kind of tie which rots in 5 years. Then we will have to replace all of the ties every 5 years, which is at the rate of 528 ties each year. This mile of track then demands an annual supply of wood from our forest sufficient to cut 528 ties.

Suppose, on the other hand, that we use a tie treated to prevent decay, which will give 15 years of service before it must be replaced. We will then need only 176 treated ties each year to keep the track in repair, and the forest will be called upon to furnish only enough timber each year to cut 176 ties, instead of 528. By the use of the treated ties, we have cut

FIG. 16.—The lumberman has removed all the timber he intends to from this area. He has left 28 per cent of the stand in stumps and tops, trees shattered in felling, small and defective logs, and whole trees of unpopular species

the drain on the forest exactly two-thirds without sacrificing one whit of the service rendered.

We are gainers in every possible way unless we have had to pay an exorbitant price for the durable tie. accomplished as if an additional 352 ties had been grown. We have substituted for a process requiring 40 or 60 years one requiring only a few hours, and have made one tree do the work of three.

FIG. 17.—In the average sawmill about 45 per cent of the log as it reaches the mill finally goes to the burner in the form of bark, slabs, edgings and trim, saw kerf, and other waste forms. In many mills some of this material is converted into small products or used as fuel, but the potential salvage is enormous

As a matter of fact, it has been shown over and over again that the treated tie is a real economy to the user's pocketbook as well as to the Nation's forests. The service rendered by the 176 durable ties is at least as satisfactory as that rendered by the 528 non-durable ties, and by making 176 ties durable the same result has been

Methods of manufacture and use of forest products which will prevent waste must of course pay their way; i. e., the savings secured must be sufficient to pay for the cost of making them. But it is not usually inability to pay their way that has retarded their adoption, so much as the fact that more and better equip-

ment is required to put the better methods into use as well as more training and care on the part of the operatives.

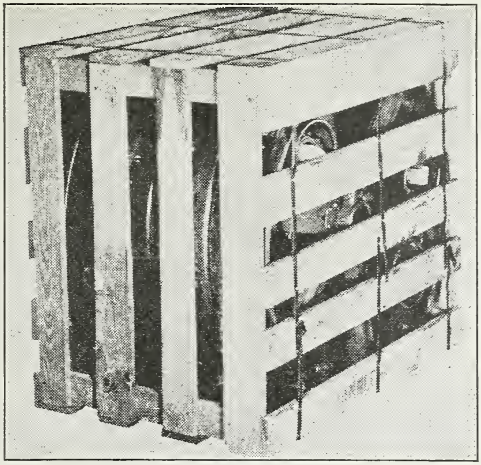

FIG. 18.—The use of an excessive amount of lumber does not insure a strong crate or box

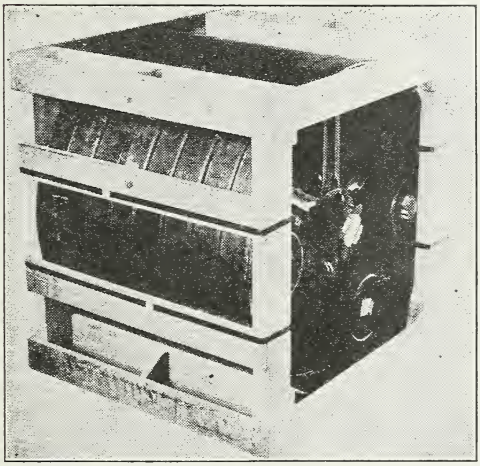

FIG. 19.—Thirteen per cent less lumber, put where it was needed for strength, produced a crate many times as strong as the one shown in the upper photograph. On the whole, box and crate manufacture is estimated to take about 8 per cent more lumber than is actually needed

Better methods of manufacture and use are continually being developed for the forest-using industries, but the rate of application is much slower than the maximum possible. The whole point is that only the maximum possible rate of progress will help much toward bridging the gap between the impending exhaustion of virgin stumpage and the availability of new forests.

A SURVEY OF UTILIZATION LOSSES—WHERE AND HOW THEY OCCUR

Two-thirds of the entire drain on the forest is lost during manufacture and use. The losses are of many kinds and types, ranging from mate-

rial which is actually thrown away to that which is manufactured inefficiently or is allowed to give way prematurely in service. Where and how do the losses occur?

DECAY

One of the largest single items of loss of forest products is decay. It occurs in standing timber, in logs stored in the woods and at the mill, in lumber and other products which are stored while awaiting use, and during use. The last-named loss, during use or "in service," is the greatest because of the tremendous amount of wood "in service" exposed to decay. The amount of lumber and timber and other wooden products in service is many times as great as the annual cut, and a loss which may be a small percentage of the amount of material in service becomes a startlingly large percentage when based upon the annual cut. In the case of railroad crossties, for instance, the annual production is approximately 110 million, whereas the actual number in service is about 1,150 million. There are about 20 million dwellings in the United States, containing at least 250 billion board feet of lumber and other sawed material; yet the annual cut of lumber for dwellings does not exceed 15 billion board feet. The same general situation exists in the case of fencing, mine timbers, poles, and other classes.

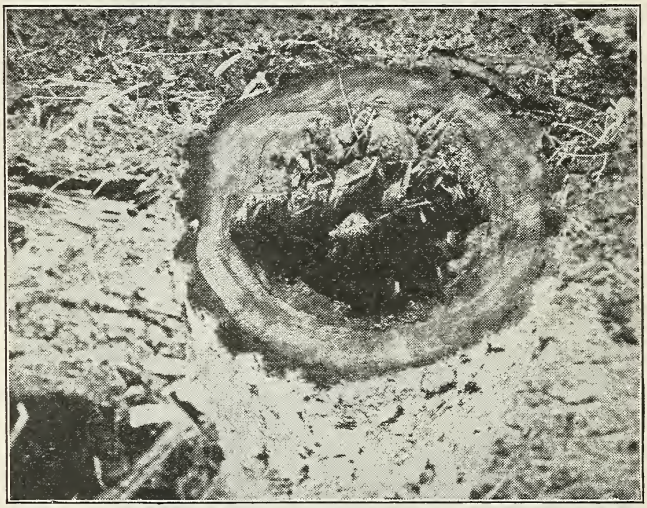

FIG. 20.—An 18-inch cull hemlock log left in the forest. In spite of the heart rot there still remains one-third of the original log, suitable for chemical pulp

Certain kinds of material are protected from decay. In indoor furniture, for instance, the annual decay loss is negligible. Some classes of material, though exposed to decay quite commonly fail in other ways; as, for instance, marine piling destroyed through the attack of marine borers.

Recent estimates by the Bureau of Plant Industry of the Department of Agriculture indicate an annual decay loss in forest products about as follows:

	Annual cut of each class needed to replace decay loss each year.
Fuel wood, per cent	7.5
Pulp wood, do	10.0
Lumber and dimension material, per cent	15.0
Railroad ties, do	50.0
Fencing, do	50.0
Mine timbers, do	20.0
Poles, do	50.0
Piling, do	25.0

The total annual loss by decay during storage and in service is estimated to be the equivalent of over 4 billion cubic feet of standing itmber—almost a fifth of the annual drain upon our forests.

WOODS PRACTICE

In the logging of saw timber for lumber and other sawed products, almost 2.3 billion cubic feet of standing timber per annum is lost or wasted. This item comprises stumps

and tops, trees shattered in felling, small and defective logs, trees of little-used species, material wasted through

of the stand involved in the operation. Woods losses in saw timber manufactured into other than sawed products

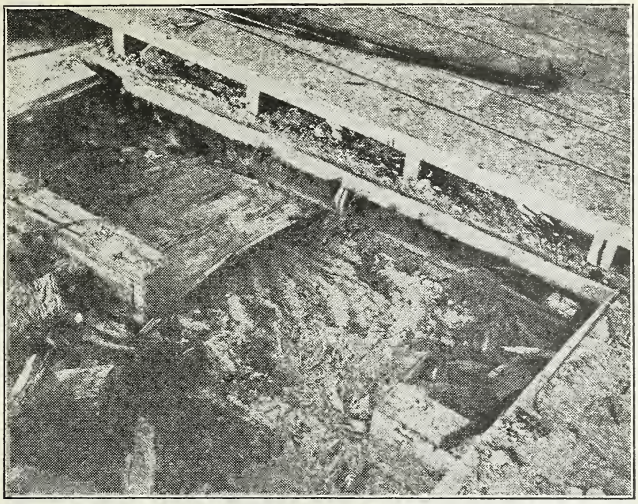

FIG. 21.—The original floor in this southern warehouse was laid on the ground. After it rotted a second was laid on top. This was followed by a third, which is now badly infected. Proper preservative treatment would have prevented all this loss. It is estimated that decay losses equivalent to nearly 1¾ billion cubic feet of standing timber are preventable

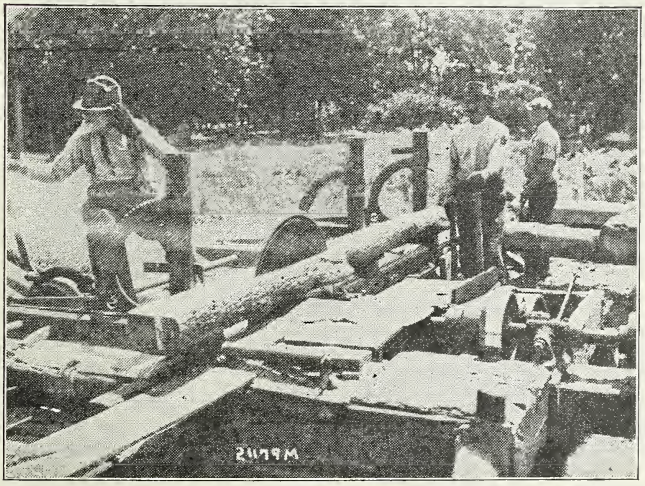

FIG. 22.—The small "portable" sawmill is an indispensable but, as yet, an inefficient part of our timber harvesting equipment. Although it salvages much timber that is overlooked in the bigger lumbering operations, it is wasteful of the individual log

bucking, the losses resulting from carelessness or lack of judgment in damage through sky-line logging. The loss is equivalent to about 28 per cent

amount to about 1.2 billion cubic feet every year, and in material smaller than saw timber to almost 2 billion cubic feet per year.

The total of all the woods losses is about 5.5 billion cubic feet per year, or about 24 per cent of the forest drain.

MILL LOSSES

About 55 per cent of the volume of the log as it enters the sawmill emerges as useful product. The remaining 45 per cent is lost in bark, saw kerf, slabs, edgings and trimmings, and culls due to mis-manufacture. The distribution is about as follows:

	Per cent of log lost
Bark	13.0
Slabs	8.7
Edging and trim	8.7
Saw kerf	13.5
Miscellaneous	3.5
	47.4

SEASONING LOSSES

Mechanical defects such as checks and cracks, loosening of knots, warping, splitting, twisting, cupping, etc., are in general caused by the seasoning process and are usually termed seasoning defects. They result in a reduction in the quality of the board or in the salable volume, or both. They may occur at almost any period during the manufacture and use of wood. The principal losses, however, occur at the sawmill and at the remanufacturing plant because it is at these points that most of the seasoning is done.

Seasoning losses occur also in forms of material other than lumber, such as structural timber, sawed and split vehicle stock, handle billets, and cooperage. Staining may occur in the log

FIG. 23.—Ten per cent of our lumber is now being cut by such mills, with unnecessarily heavy wastage through the use of thick saws and mismanufacture

The annual gross loss is thus over 2.8 billion cubic feet of standing timber. Since some of this waste is converted into lath, box shooks, and other small products, the net loss is appreciably less.

Losses in the barking, chipping, and grinding operations in making wood pulp and converting the pulp into paper are estimated at about 720,000 cords per year. A large percentage of the loss occurs in barking, particularly when knife barkers are used. The losses are sometimes as high as 33 per cent of the net volume.

itself. A reduction in the heat efficiency of fuel wood due to incomplete seasoning represents an important waste.

The sum total of the various seasoning losses represents over 1 billion cubic feet of standing timber per annum, or more than 4 per cent of the forest drain.

REMANUFACTURE

Wastes and losses in remanufacture are those which occur in the production of finished articles from lumber and dimension material. Typical ex-

amples are furniture and chairs, boxes, vehicles, and automobiles, woodenware.

Cutting up the lumber and dressing it to the proper sizes and shapes product, the remainder being lost or wasted. The total of all remanufacturing losses exceeds in amount the equivalent of one-half billion cubic feet of standing timber annually.

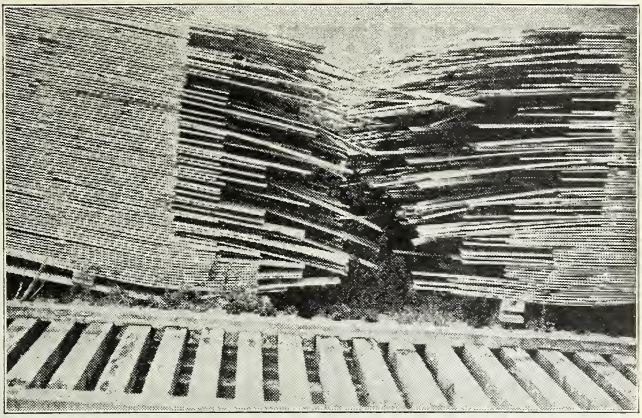

FIG. 24.—This is an illustration of an extreme in the piling of lumber of mixed lengths and in poor placing of foundations. The effect on the lumber is obvious. Proper piling and yard sanitation are among the least expensive and least troublesome means of conserving wood which can be applied at once. Lumber which is worth piling is worth piling well

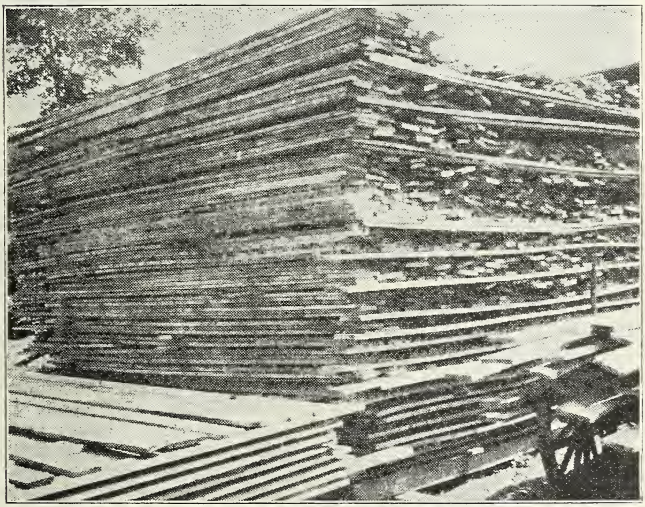

FIG. 25.—Some of the layers in this lumber pile seem to have been heaped rather than piled. After the first few single layers had been piled and stickered after a fashion, the piling grew more and more slipshod. As it stands, the pile offers excellent incubation condition for sap stain and it practically guarantees some form of warp for most of the boards.

are the principal operations in which the waste occurs. For instance, only 60 per cent to 75 per cent of the lumber remanufactured into furniture and chairs appears in the finished

UNCLASSIFIED LOSSES

A total annual loss of at least 1 billion cubic feet of standing timber is caused by waste occurring in a

wide variety of forms, each comparatively small in amount, among them the following:

1. Improper design of structures.
2. Unsuitable grading rules.
3. Failure to use short and odd lengths of lumber.
4. Destructive turpentine orcharding methods.
5. Staining of sapwood.
6. Wasteful processes in the manufacture of chemical pulp.

ELIMINATING NOW PREVENTABLE WASTES WOULD SAVE TWO-NINTHS OF THE PRESENT DRAIN ON THE FORESTS

Upon the basis of present wastes and losses, the present status of research in forest products, and present economic conditions, the Forest Service has made a detailed estimate of the savings which could be made in the drain on the forest if our best present knowledge were applied throughout all of the various steps in the manufacture and use of forest products wherever commercially and economically feasible.

The total of this estimate is 5½ billion cubic feet per year.

This amount is more than two-ninths of the present annual forest drain and nearly equals the total present growth of timber over our entire forest area.

DECAY

It is estimated to be economically possible to save about 47 per cent of the annual decay loss, or almost 1¾ billion cubic feet. Expressed on the basis of the total annual cut of 22.4 billion cubic feet, this amount represents 7.7 per cent. It is, of course, made up of a large number of small items, the more important of which are the following:

	Savings in 22.4 billion cubic feet
Decay prevention in—	
Planing-mill products—per cent	1.30
Fuel wood—do	1.00
Hewed ties—do	1.00
Common boards and dimension—do	.80
Sawed ties—do	.53

The methods to be employed consist principally in use of wood preservatives, in sanitary storage, and in the design of structures so as to avoid conditions favorable to decay.

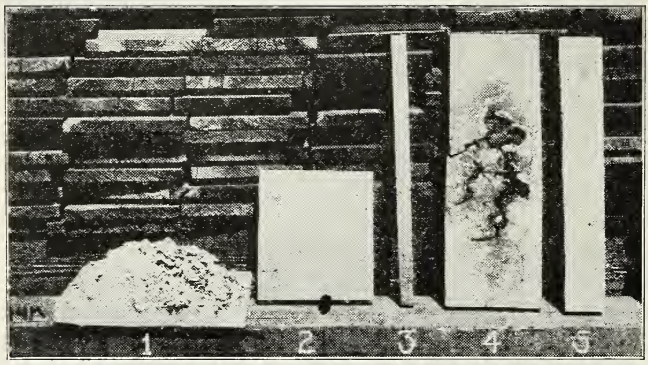

FIG. 26.—Where waste occurs in factory cut-up operations: (1) Sawdust, (2) end trim at the cut-off saw, (3) edging at the ripsaw, (4) waste at the ripsaw, (5) waste at ripsaw due to knot defect at the upper end. On all these wastes freight has been paid from mill to factory; and the wastes have also absorbed their share of lumber costs, handling, storage, and other overhead charges. Five hundred million cubic feet of wood are lost every year in remanufacture

LOGGING WASTES

It is estimated that the logging losses in the production of lumber, structural timber, and common boards and dimension are about 28 per cent of the standing timber cut for these items. At least one-quarter of this loss is waste which could be saved economically under average conditions. The estimated saving, expressed in percentage of the annual cut, for the above classes of material is distributed as follows:

Preventable waste in—	Soft-wood	Hard-wood
Breakage—per cent	1.0	0.2
High stumps—do	2.5	1.0
Improper lengths—do	0.5	0.5
Tops—do	2.0	5.0
Total—do	6.0	5.0

This would represent a saving of one-half billion cubic feet of standing timber per annum.

It is estimated that about one-third of the woods loss occurring in the hewing of ties can be economically avoided through sawing the ties whenever practicable, and by using greater care in the selection of the trees and utilizing the tops in so far as conditions permit. This saving would amount to about one-eighth billion cubic feet of standing timber per annum.

Avoidable woods loss in the round timber group (fencing, mine timbers, poles, and piling) is not great, since the stumps are usually cut low and the tops high, and the loss from breakage is negligible since not much large timber is used. The avoidable waste is thus eliminated.

Preventable waste in—	Drain for round timber
High stumps	per cent 1.0
Improper lengths	do 0.2
Tops	do 1.0
Total	2.2

The saving in round timber would amount to about one-twentieth billion cubic feet of standing timber per annum.

The total preventable logging waste is estimated to aggregate over two-thirds billion cubic feet per year.

MILL WASTE

Waste which is now economically preventable in the sawmilling of lumber and other sawed products amounts to about one-half billion cubic feet per annum (exclusive of savings through remanufacture into dimension stock). The circular head saws used for cutting about 42 per cent of the total production of sawed material waste every year, in excess saw kerf, an amount of wood equivalent to two-thirds billion cubic feet of standing timber over and above that which would have been wasted had band saws been used. Needlessly heavy allowances for mismanufacture, shrinkage, and dressing account for another one-third billion cubic feet per annum. It is estimated that one-half of each of these two classes of waste is now avoidable.

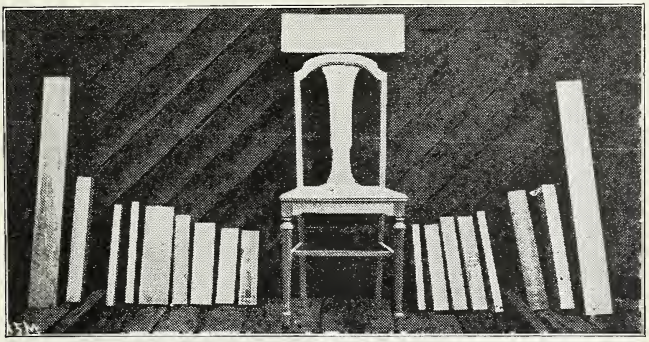

FIG. 27.—A chair "in the white" with all the pieces of rough dimension which go to make it up. Large quantities of good quality material of this sort can be found in the waste pile of the average sawmill. A total saving of about three-fourths of a billion cubic feet of standing timber could be realized annually by cutting small dimension stock from woods and mill waste wherever now feasible.

SEASONING LOSSES

It is not commercially feasible at the present time to entirely avoid degrade in seasoning lumber, because a perfect seasoning operation is too long and too costly.

Degrade can be reduced, however, even under fast-drying schedules. In southern pine, for instance, research has devised 72-hour kiln-drying schedules which have reduced degrade from about 20 per cent to 5 per cent in the upper grades and from about 30 per cent to 10 per cent or less in the common grades.

A careful analysis of degrade losses occurring in the air seasoning and kiln drying of many kinds of wood indicates that avoidable wastes are large, and that the present average seasoning practice compared to the best present commercial practice is poor and could be much improved through the employment of competent operators and the maintenance of drying

equipment in first-class condition. Still further savings could be effected by remodeling antiquated kilns and installing modern equipment.

About two-thirds, or two-thirds billion cubic feet, of the present losses are estimated to be avoidable. This estimate applies only to sawed products.

SMALL DIMENSION STOCK

The use of dimension stock offers tremendous possibilities in the more efficient utilization of wood.

By dimension stock is meant material which is ready-cut to the proper dimensions for remanufacturing into specified products. Dimension stock is now cut largely from boards at the factory and the possible saving would lie in cutting it at the sawmill from woods and mill waste and from low-grade lumber.

Cutting dimension stock from mill waste is now practiced to a considerable extent for automobile body parts and in the case of certain specialized products such as spools, handles, and other turned stock, but the custom has not become nearly as widespread as its possibilities would justify. An important reason lies in the present lack of standardization of sizes and other requirements, and the failure of producer and consumer to come to a mutual understanding. It is very important that the industries overcome these superficial obstacles.

Large percentages of the present woods and mill wastes are of high-grade material admirably adapted to the manufacture of clear dimension stock. This is especially true of slabs. To continue to cut it from boards, therefore, seems a clear case of preventable waste—especially since the cutting up of edged and trimmed boards into dimension stock at the factory is in itself a very inefficient and wasteful process.

Heretofore, most dimension stock has come from hardwoods, but there is no logical reason why softwood dimension stock should not likewise be used. Large quantities of softwood boards are cut up each year into small pieces in the manufacture of furniture and woodenware, toys and novelties, and in making sash, doors, and millwork. The small pieces might just as well be obtained in the form of dimension stock ready cut to specification from mill waste.

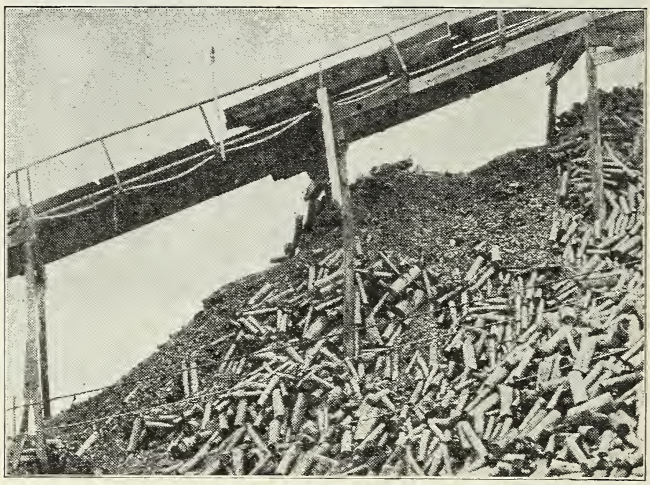

FIG. 28.—The bark sifting down on this pile of pulpwood will hold the moisture from rains and form a splendid incubating medium for the fungi which decay pulp wood. Preventable decay losses in pulp-wood storage yards managed without regard for sanitation amount to over 29,000,000 cubic feet annually

The most obvious use for dimension stock is in furniture, chair, and box manufacturing plants, and in the numerous plants making specialties ranging from pianos to clothespins. Especially in the furniture, chair, automobile body, and box and crate industries a very large percentage of the total demand for wood can be met by the use of dimension.

A total saving of about three-fourths billion cubic feet of standing timber can be realized annually by cutting small dimension stock from woods and mill waste wherever now feasible.

MISCELLANEOUS SAVINGS

No attempt has been made to present all of the possible items of preventable savings; there are very many small savings which can be effected in the various wood-consuming industries and by the Nation as a whole. The sum total of such savings probably exceeds a billion cubic feet of standing timber annually. The largest savings can, in general, be made where the greatest wastes occur, as in the remanufacture of lumber into furniture, chairs, woodenware, etc., the conversion of wood into pulp and paper and other chemical products, and the turpentining of southern pine. There are also avoidable losses arising from poor design of structures, unsuitable grading rules, and the sap staining of wood during manufacture and storage.

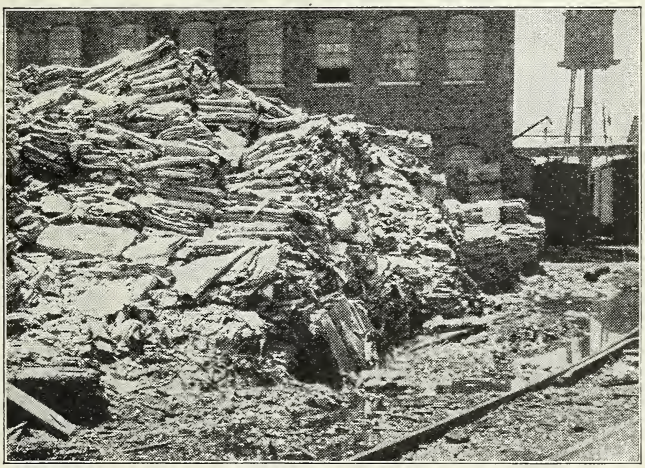

FIG. 29.—The pulp manufacturer who piled this ground wood pulp on swampy ground that had no drainage or surfacing of any kind showed little regard for his product. It is estimated that decay of stored pulp and pulp wood reduces the profits of the ground wood pulp mills by $6,000,000 every year

ULTIMATE SAVINGS CAN DOUBLE THOSE NOW FEASIBLE

Conservative estimates show that by methods now known and available we can reduce the drain upon the forests over two-ninths without reducing the amount of use or service rendered, and without adopting any methods or practices which are not now commercially feasible or economical.

What does the future hold in the way of still better methods?

Research and better organization of industry are each year disclosing new economies in wood, and we may safely predict that they will continue to do so, even beyond the now feasible economies of two-ninths the annual drain. As timber grows scarcer we may expect, for instance, a trend toward the use of the slow but efficient methods of lumber manufacture employed in Europe. In spite of the wonderful mechanical development of the American type of sawmill machinery, and the terrific punishment which it is capable of withstanding under high-speed, grueling service, it is well recognized as being more wasteful of lumber than the European types, and it has not found favor in Europe because of this fact. It will never be possible to secure perfect utilization, since we can not eliminate entirely such items as slabs and edgings, sawdust and planer shavings, or allowances for variations in sawing and variations in shrinkage of the wood as it dries. It seems probable, however, that the additional savings which may be expected in the future will be as great as those now feasible, in which event the ultimate possible savings would be 10 billion cubic feet per year, or four-ninths of the present drain.

WHAT CAN BE DONE TO MEET THE IMMEDIATE CRISIS

The purpose of the National Conference on Utilization of Forest Products is to devise a comprehensive plan for easing the stringency of the immediate future and carrying the wood-using industries through to a

period of increased supply. The foregoing is simply a summary of the relevant facts, as seen by the Forest Service.

The following are suggestions as to the nature of the action required. There is no attempt at completeness in either subject matter or detail.

The first thing needful is a recognition by the forest-using industries of the fact that the perpetuation of their supply of raw materials and the permanence of the communities dependent on them demands the immediate adoption of all practicable known methods for preventing wood waste. In this connection it must be borne in mind that forest-using industries include not merely lumbermen and lumber mills, but all of the complex network of industries that depend upon wood.

Secondly, it seems necessary to disseminate, on a truly national scale, knowledge of the present best practice in wood utilization, so that nobody need use wasteful methods because he knows no other. "Best practice" has been evolved in part by progressive firms or individuals; in part it has been discovered by organized research; but regardless of its origin, every wood user (and this includes in some sense every citizen) should have every possible opportunity of applying it. In the huge task of dissemination the existing organizations of the forest-using industries, the entire system of universities and technical schools, the public press, and possibly even a Government extension service similar to the county agent service must be used as media of education.

The third necessity is to iron out the obstacles, often needless and accidental, which separate each piece of wood from its highest possible use. The problem is largely one for industrial surveys, standardization of specifications, and mutual education of buyer and seller. Here again the trade associations are the most hopeful medium, although the Government should be prepared to furnish such assistance or technical advice as may be necessary to initiate adjustments.

The fourth thing needful is research. Scientific investigation should forge ahead into the vast field for savings not yet economically feasible but often capable of becoming so with slight improvements in technique. The Government for a number of years has maintained its own program of research in forest products, but the need for expansion is now so great that the program should possibly spread to the whole national system of technical schools and private laboratories, with the Government laboratory functioning simply as a coordinating center. Special consideration should be given the question whether the industries should not initiate research into more economical machinery.

Fifth, the economic factors bearing on forest utilization should be thoroughly reviewed to see if there are any obstacles to better utilization in the form of tranportation rates or rules, tax status, grouping of industries, or the like, which could logically be removed.

The tasks ahead may look formidable, but their performance can not possibly be as onerous a burden to the forest-using industries or the Nation as would be the consequence of their neglect.

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