Georgia State Forestry Department

B. M. LUFBURROW, State Forester.

Bulletin No. 1

Forest Fire Control Policy

for

Georgia

By

B. M. LUFBURROW

PROTECTION
CONSERVATION
PERPETUATION
GEORGIA
FOREST SERVICE

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FOREWORD

The Georgia State Forestry Department is charged with the task of assisting the people of Georgia in protecting from fire twenty-two million acres of forest land. This Department was created in the summer of 1925; it was organized and the work was begun later in the same year. Since the organization of the Department there have been many inquiries by landowners and the general public, about the State's forest fire policy. This pamphlet is printed to supply the demand for this information.

'RGIA'S FOREST FIRE CONTROL POLICY

NEED FOR FOREST PROTECTION

ia has some 22,000,000 acres of potential
ınd that is either growing trees or nothing.
steep, too stony, too poor, or too far from
:o be used for plow land at the present time;
le the demand for food and clothes by an
ıg population may in time require that some
and be put under plow, it is not likely that
ill be a great reduction of the forest area
' years to come. In the meantime the de-
r forest products, such as lumber, pulpwood,
ne and rosin is so great that the growing of
s the most profitable use that can be made
land. This forest area, if protected from
put under forest management is capable of
ıing an industry that should contribute at
'5,000,000.00 annually to the wealth of
Such an industry deserves protection and
;ement both from the State and the indi-
Some 90% of these 22,000,000 acres will
aturally if forest fires are kept out. The
g 10%, consisting of old fields, badly burned
and clear cut areas which have no seed
e to repeated fires, must be restocked arti-
Again, the rate of growth on the protected
here the litter and humus has accumulated
.e absence of fires, will be more than double
the area where annual fires occur.

:EST FIRE PROTECTION MUST BE COOPERATIVE

ıld be impossible for the man in the city
ct his home, but for cooperative effort.
ıdividual throughout the city detects and
ires to the Fire Department; and this com-
of individual and collective effort gives him
n. The individual who wants to protect his
ıd has greater obstacles to overcome, for
bor may not see the necessity of protecting
t land and may be careless with fire. The
ıl has no authority to enforce the laws, or
aid in preventing or suppressing fires and
the cost of protection on small areas is relatively higher because it requires nearly as many fire tools, equipment, improvements, and patrol as a number of small areas combined would require.

Adequate forest fire protection, for Georgia's 22,000,000 acres, thru cooperative effort will cost approximately $450,000.00 or 2¼ cents per acre per

annum. This estimate is less than seven-tenths of one percent of the annual income from Georgia's forest lands and is based on organized effort. Individual effort would cost three times as much. All efforts must be coordinated, if the forests of the State are to be protected at a minimum cost.

STATE AID.

Organized efforts of groups of land owners in various parts of the State have been incomplete. The most desirable results are accomplished thru state-wide efforts and cooperation with the State. In this way the organization can receive not only financial aid but the expert advice and assistance of state forest officers trained in this work.

TIMBER PROTECTIVE ORGANIZATIONS

The organized effort of a group of timberland owners in close cooperation with the State offers the most economical and practical method of fire protection for the cost can be reduced to a minimum. The technical work and necessary supervision can be done by State officers without cost to the organization, which will allow all funds of the organization to be spent in actual prevention and suppression work. This policy will be applied to all forest protection work in Georgia as fast as funds become available for the work.

HOW OWNERS CAN ORGANIZE

Financial assistance can be had only thru a cooperative agreement between duly elected officers of the organization and the Georgia Forestry Department. Individual agreements must be signed by each owner and his pro-rata share paid to the Treasurer of the Organization before he becomes a member and is eligible to receive the benefits of the organization. The total acreage of the Organization must amount to 10,000 acres or more before the cooperative agreement will be accepted by the State. The larger and more compact the area, the less the cost of protection and for this reason every effort should be made to include every owner in each organization area.

No state or federal aid will be advanced to an organization, but vouchers showing the actual amount disbursed by the organization are forwarded to the State Forestry Department quarterly and the

refund is made to the organization on the basis called for in the cooperative agreement. The total refund will not exceed fifty percent of the organization expenditures.

FINANCING THE ORGANIZATION

1. On or before July 1st of each year the members of the organization pay to the Secretary and Treasurer of the Organization a sum equal to the rate per acre agreed upon by the Organization for each acre listed with the Organization, and this payment represents the members share of the cost for the following twelve months period.

2. The State will refund 25 to 50 per cent of the total spent by the organization.

3. The combined fund must be used for forest fire protection on the Timber Protective Organization area.

4. The salary or expenses of a State or Federal officer is not charged against these funds.

5. On June 30th of each year the Timber Protective Organization must make a financial statement both to the State and to its members showing how the funds have been expended.

6. A voucher requesting state refund must be submitted at least quarterly, and monthly if desirable.

7. Unexpended balances which may be on hand on June 30th of each year will be allowed to accumulate as an emergency reserve fund until the fund reaches a total of $500.00. This reserve fund must be used only when necessary to meet emergencies caused by unusual fire seasons.

8. Should the unexpended balance from the previous year exceed $500.00 the amount of this excess will be used to reduce the assessment for the following year.

PERSONNEL

1. The State Forester and his assistant, officially designated the Chief of Protection, formulate plans for forest fire control in the State. All matters of policy must be approved by these officials.

2. The Chief of Protection is responsible for the execution of the forest fire control policy of the state and all Timber Protective Organizations are under his jurisdiction.

3. The officers of each Timber Protective Organization must consist of a President, Vice-President, and a Secretary-Treasurer, who have lands listed in the Organization and who must be elected by the members. The officers serve without compensation. Their duties are to represent the Organization in working out plans for protection of the lands listed with the Organization.

4. Each organization is in charge of a Chief Patrolman, who is preferably a local man, so qualified for his duties as to be acceptable to the Chief of Protection and the officers of the organization and he is responsible to these officials for the proper functioning of the protection work of the organization.

5. Any Timber Protective Organization embracing 40,000 acres or more, may be divided into districts and each district be in charge of a Patrolman or (Deputy Forest Warden) who is responsible to the Chief Patrolman for all work in his district, such as educational work, fire detection and suppression, construction of towers, telephone lines, fire lines, roads and trails, etc., and any other work necessary for the protection of his district.

6. The Governor on recommendation of the State Forestry Department commissions all patrolmen as Deputy Forest Wardens. When the commission and badge are received, the Deputy Forest Warden will have authority to make arrests for violation of the Fire Law.

7. Per diem wardens, local residents who assist the patrolmen in detecting and suppressing fires in the immediate vicinity, may also receive Deputy Forest Warden commissions upon recommendation of the patrolmen and the approval of the Organization.

8. Where the acreage covered by the Timber Protective Organization is 100,000 acres or more, the State Forestry Department recommends the construction of lookout towers for detection purposes. These towers should be manned during periods of fire danger and connected with all parts of the organization area by telephone.

The detection of a forest fire at the earliest possible moment and being able to have the crew start work without delay are two vital factors in forest protection work.

The efficiency of the personnel and the success of the organization will depend largely on the amount of thought and study given to the activities undertaken. Therefore a carefully devised plan of work drawn up by the Chief of Protection, officers of the Organization and the Chief Patrolman should be worked out. This should cover:

Fire Atlas:

1. A map showing,
   - (a) Area covered by organization.
   - (b) Location of Districts.
   - (c) Location of Patrolmen, Deputy Wardens and Keymen.
   - (d) Location of towers, lookout points, telephone lines and stations, roads, streams and all natural barriers.

2. A map showing the location of each fire. This should cover a period of ten years. It is most valuable in analyzing the fire risk and enables the Chief Patrolman to concentrate on the section where the danger is the greatest.

3. A budget covering amounts to be spent for:
   - (a) Fire Prevention.
   - (b) Improvements (permanent and temporary).
   - (c) Equipment.
   - (d) Fire suppression.

Execution of this plan, after its approval, is as follows:

1. Chief Patrolman is responsible, assisted by Chief of Protection.

2. Patrolmen, Deputy Forest Wardens, and Keymen are to be recommended by Chief Patrolman and when employed, given definite instructions as to their duties. Chief Patrolman will,

(a) Aid patrolmen in selecting key men, law enforcement and educational work.

(b) Specify amount of time to be spent on each activity and inspect their work.

(c) Distribute supplies, equipment and fire signs.

(d) Approve all reports and supervise the location and construction of all improvements.

Realizing that the prevention of forest fires, over 90% of which are man-caused and due to thoughtlessness and lack of knowledge, the major portion of the patrolman's work will be educational in character. This work consists of establishing personal contacts with all agencies within his district, with sawmills, logging camps, visiting schools, posting fire notices and giving specific information to all people which will show the necessity of preventing fires and the relation between the forests and the prosperity of the community. He will also be responsible for the detection and suppression of all forest fires in his district, as well as the organization of fire fighting crews, and he will take direct charge of fires which may occur in the district; he will be responsible for the enforcement of the fire law; he will recommend to the Chief Patrolman, Deputy Forest Wardens in his district to assist him in the prevention and suppression work. The lookouts, where towers are constructed, will be responsible for the detection and reporting of all fires to the party responsible for suppression work and he will occupy his post during the period of fire danger. He should not be called upon for suppression work except in cases of emergency. He may, however. be used for improvement work (if employed by the month) during such periods when there is no fire risk.

HOW THE ORGANIZATION OPERATES

1. The area of the Timber Protective Organization is determined by the lands listed.

2. The officers are elected by the members who have listed their lands and paid their dues.

3. A Chief Patrolman is employed.

4. The money is budgeted and plans decided upon. The organization acreage of the Timber Protective Organization is divided into districts and patrolmen employed, given instructions and assigned to the district.

5. The patrolman selects the Deputy Wardens who are to assist him in his work.

6. The Chief Patrolman starts to work locating the sites for permanent improvements and when approved construction work is begun under his direction.

7. The Patrolman collects evidence for prosecution of fire trespass cases. Chief Patrolman and a State officer will assist him in working up and prosecuting the case.

No surplus funds at the end of the year may be used for permanent improvements and equipment but are held as emergency funds.

IMPROVEMENTS

Lookout towers are most effective in the detection of forest fires. The points to be considered in the location of these towers are:

1. Height of ground or elevation.
2. Telephone connections and other communication facilities.
3. Area to be covered.
4. Accessibility.

Each tower should be equipped with a field glass, map, allidade and compass for detecting and locating fires. They should be connected with telephone lines to all parts of the area under protection and especially to the points where the fire fighters are located. They should be manned during periods of fire danger.

TELEPHONE CONNECTIONS

Telephone lines should be constructed with the idea of tying in the personnel of the organization in all parts of the areas with the lookout points so that fires may be reported and extinguished as soon as detected. The plans for the organization should include the construction of these lines as fast as funds will permit. Through cooperation with the local residents, it is possible for the organization to furnish the material and the local residents to furnish the labor for construction on a cooperative basis. The location of lines and the distribution of telephones will be determined by the Chief Patrolman with the approval of the Chief of Protection.

AGREEMENTS

The organization must have an agreement with all employees, both temporary and permanent, as to salaries and wages. The permanent employee is paid on the yearly basis and a temporary employee may be paid on the monthly, weekly or hourly basis, the amount depending upon the prevailing local rates.

It is necessary to agree upon the traveling expenses incurred by the personnel. The Chief Patrolman may be reimbursed for expense while away from home on organization business. The patrolmen will not be allowed traveling expenses except when authorized by the Chief Patrolman and on the approval of the Chief of Protection.

Before an organization can function under the law the following agreement must be signed by an officer of the Organization and the State Forester.

AGREEMENT

between

THE GEORGIA STATE FORESTRY DEPARTMENT

and

The .....

of .....

WHEREAS, the Clarke-McNary Reforestation Act (43 Stat. 653) provides, among other things, that the U. S. Forest Service may cooperate with the various states in forest fire protection; and

WHEREAS, the U. S. Forest Service has determined that certain expenditures for forest fire protection properly made by private land owners may be included as a part of the basis for reimbursement to the State; and

WHEREAS, under sections 3 and 6 of the Georgia Forestry Law of 1925, the State Forestry Department is authorized to cooperate with private land owners in forest culture and preservation;

THEREFORE, it is agreed,

That, effective.....19.....,

the said.....,
will provide the forest fire protective system described below, organized in cooperation with the State Forestry Department, to cover its lands in

.....

.....Count.....;
as shown on the attached map which is made a part of this agreement.

LANDS TO BE PROTECTED:

Area .....

Location .....

Forest Conditions.....
Virgin, Culled, Cutover, Second Growth.

PROTECTIVE ORGANIZATION:

Administration .....
Character, Cost per annum.

Fire Wardens and Patrolmen.....

.....
Duties, Number, Cost per annum.

IMPROVEMENTS, CONSTRUCTION AND MAINTENANCE:

Fire Lines, Telephone Lines, Towers.....

.....
Kind, Number of miles, Cost per mile.

All Other Expenditures.....
Kind and Cost per annum.

Total Cost per Acre per Annum.....

2. That, the said.....
authorizes the appointment, by the Governor, of its principal forest protective employees as Deputy Forest Wardens; keep a record of expenditures incurred in connection with such protective system showing for each expenditure, the voucher, date of payment, name and address of payee, purpose or object to which applied, and the amount.

3. That, the State Forester may exercise direct supervision of these protective measures; that, the Chief of Protection or authorized officials may at any time inspect the area, and the State Forester and Federal Inspection officer, under the Clarke-McNary Law, may have access at all reasonable hours to the books and voucher files to check expenditures under this agreement; and

4. That, in the event of credit being gained to the State by reimbursement thereto of any part of the fire protective expenditures made by the.....

.....,

the State Forestry Department will, upon receipt by the State Forester of proper vouchers covering such expenditures, refund, an amount not to exceed 50 per cent of said expenditures to the said

.....

This Agreement becomes binding on the day it is signed by the contracting parties and shall continue in force thereafter, subject, however, to the funds available under the Acts of 1925 for carrying out this work, and,

It is expressly understood that this agreement, or any modication thereof cannot be terminated by either party without sixty (60) days notice, in writing, to the other.

IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed, this

.....day of.....19.....

GEORGIA STATE BOARD OF FORESTRY,

By .....

Title .....

.....

By .....

Title .....

REPORT SYSTEM

1. The Deputy Forest Wardens' report should be verbal and made to the District Patrolman.
2. The District Patrolman reports consist of:
   - (a) A diary submitted monthly, showing work done and expenses incurred.
   - (b) Individual fire reports.
   - (c) The individual law enforcement reports.

All reports of the patrolmen are forwarded to the Chief Patrolman, who will approve and forward to the officers of the Organization and the Chief of Protection at the State Forester's office.

All expenditures must be approved by the Secretary and Treasurer of the Timber Protective Organization and the Chief of Protection, before a refund can be had from the State.

COUNTY SYSTEM

It is realized that all forest land in this State that is in need of protection cannot receive the intensive protection contemplated in the above organization, because the land is scattered over a considerable area and the telephone, lookout and patrol system would be too expensive. For forest regions of this kind the fire control work can be organized in one of two ways:

1. Grouping the timberland owners in the Timber Protective Organizations with the lands less frequently patrolled and the improvements and equipment covering larger areas.

2. There is a total of 96 County Police employed in 58 Counties in Georgia. Under Section VIII of the Georgia Forestry Law these men can be appointed County or Deputy Forest Wardens and head up the forest fire control work over the County.

The County Commissioners and the Chief of Protection plan the work which the County Wardens are to do.

The County is divided into districts. The County Warden recommends to the County Commissioners the appointment of Deputy Forest Wardens in each militia district and these Deputies are selected because of interest in the forestry work, influence in the community, personality and leadership. They serve without compensation.

The County Wardens duties are primarily educational in character. They consist of law enforcement work, informing the public of forestry laws, posting fire signs, visiting schools, saw mills, logging camps, etc., pointing out the necessity of being careful with fire in the woods and the influence of the forests upon the health and prosperity of the community.

The County Warden is responsible for the detection and suppression of forest fires within the County.

The Deputy Wardens are responsible to the County Warden and their activities are confined to the militia districts. They are responsible for the detection and suppression of fires within their districts and report to the County Forest Warden.

The County Forest Warden shall report the individual forest fires showing the cause of the fire, number of fire fighters employed, the acreage burned and an estimate of the damage.

The County and Deputy Forest Wardens receive a commission from the Governor and a badge from the State which gives them the authority to make arrests for violation of the fire law.

It will be the duty of the County Forest Warden to collect evidence and handle all cases which are prosecuted under the fire law. The Chief of Protection will assist in the prosecution, if so requested by the County Warden.

A limited amount of fire signs, posters, bulletins and leaflets, etc., will be furnished by the State Forestry Department to each Forest Warden. The Chief of Protection will also assist the County Warden in organizing the County and will talk at any meetings arranged by the County Forest Wardens and will assist in the work with the private timberland owners and in other work that will help protect the forests of the County.

BULLETIN NO. 2

State of Georgia
State Board of Forestry

FOREST THINNING

By

ALFRED AKERMAN

Atlanta, Georgia

March, 1928

STATE BOARD OF FORESTRY

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J. LEONARD ROUNTREE, *Representing Farming Interest.*

BONNELL HAROLD STONE, *Representing Timber Land Owning Interest.*

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BONNELL HAROLD STONE, *Assistant State Forester, without pay, in Charge of Education and Publicity.*

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EVERETT BASCOM STONE, JR., M. F., *Assistant State Forester, in Charge of North Georgia District.*

CHARLES WAYNE NUITE, B. S. F., *Field Assistant, South Georgia District.*

EITEL BAUER, B. S. F., *Field Assistant, Management and Research.*

FOREST THINNING

I

Importance of Thinning in Georgia

There are about 23,000,000 acres of forest land in Georgia. About 90% of this area renews itself by sprouts and natural seeding, provided the natural renewal is not interfered with by fires during the renewal period. On about 10% of the land the natural reproduction needs to be supplemented by planting or artificial seeding to get a full stand. Accident plays a part in natural reproduction, and the resulting stand may be too dense or it may be a mixture in which worthless kinds of tree occur along with valuable kinds. To make the most of the bountiful reproduction which nature provides, the crowding in dense stands must be relieved and the percentage of worthless trees in mixture must be reduced. Moreover, where valuable kinds come in naturally and with the right spacing or where they are introduced by artificial means, there must be some removal from time to time as the stand grows, or crowded conditions will develop, although there was no crowding at the start. It follows, therefore, that to correct the accidents of natural reproduction and to keep the natural and the planted stands in thrifty condition, well nigh every acre of the 23,000,000 must be thinned one or more times while the timber crop is growing, if those 23,000,000 acres are to produce the large crops of timber that our increasing population and our expanding industries will demand of them. Next after protection from fire, the Georgia forests stand in need of systematic, intelligent thinning.

II

Principle on Which Thinning Works

Thinning is the removal of some of the trees from a stand while it is growing for the benefit of the trees that are left. Suppose that a young stand starts off with the trees about 6 feet apart each way, or 1210 to the acre. When the stand is about 10 years old, or sooner in the case of some of the fast-growing kinds of tree, the limbs begin to touch and the lower limbs begin to die.

Some of the trees in the stand grow up faster than the others, and in a few years their tops will be above the general level of the stand, some will have their tops at the general level, some will be overtopped, and some will be dead. By the time the stand is 50 years old there may be left only 500, or less than 500, of the original 1210 trees; the others have been crowded out by their stronger neighbors. If, as often happens in natural seeding, there are several thousand trees on an acre at the start, the crowding will be greater and the effects of it will be more marked.

Moderate crowding does the stand good. It makes the trees grow tall and shed their side limbs. Long, clean trunks that saw out clear lumber are the result of crowding. But the competition in a dense stand may become too strong; and when it does, it may react in a harmful way on the trees that live and form the final crop, slowing down their rate of growth and lessening the volume of the final crop. By removing some of the trees from time to time as they increase in size the beneficial influences of the competition can be continued and the harmful effects can be prevented.

Since thinning is based on the principle that a stand can be kept thrifty by cutting out some of the trees, methods of thinning, how soon to thin,

how often to thin, and what trees to cut out will depend to some extent on the classes into which the trees become separated by competition, and these classes must be defined for a clear understanding of the discussions that follow. (1) Dominant trees have crowns above the general level of the crown cover, getting full light from above and some light from the side. (2) Co-dominant trees have crowns at the general level of the crown cover, getting full light from above but little light from the side. (3) Intermediate trees have crowns below the general level of the crown cover, getting some light from above but none from the side. (4) Overtopped trees get no direct light from above or from the side.

Diagram showing height classes in crowded stand; (1) dominant, (2) co-dominant, (3) intermediate, (4) overtopped.

III

Methods of Thinning

Several methods of thinning have been used, but the method most used is to start with the overtopped class and to proceed upward into the intermediate and co-dominant classes until enough trees have

been cut out to relieve the crowding. This method is the one recommended to be used in ordinary conditions, but it may be modified to meet extraordinary conditions. The overtopped trees may be too small to pay to cut, and the thinning may begin with the intermediate class. Some of the dominant trees may be very crooked or very limby, and they may be cut out and the co-dominant and intermediate trees surrounding them may be left undisturbed until the next thinning.

IV

How Early and How Often to Thin

The age at which it may be practicable to thin a young stand depends on the market for small material. Where there is a market for small material a young stand may be thinned earlier and the thinning may be repeated at shorter intervals than where there is a market for only large material. Ordinarily the safe rule to follow is to thin a young stand when the material to be removed has reached such a size that its sale will pay for its removal and not to thin it again until there is enough material to be removed to yield a profit, or at least to pay for its removal. Thinnings in an old field pine stand in Georgia seven miles from a market for cordwood have shown that such stands may be thinned when nearing 20 years of age and that the thinning may be repeated at intervals of seven years. Stands closer to market might be thinned a little earlier, in some cases as early as 15 years; and the thinning might be repeated at intervals of 5 years. With stands farther than seven miles from market it might be necessary to put off thinning until the 25th year or longer, and the interval might be lengthened to 10 years. If the stand is composed of slow-growing hardwoods in-

stead of pine, the first thinning would have to come later and the interval between thinnings would have to be longer than for pine.

Stands on small farm holdings may be thinned earlier and more often than on large timberland holdings. There is a demand for firewood, posts, and barn poles on the farm, and these requirements may be met in whole or in part by thinning. Nearly all of the firewood, posts and barn poles used in Georgia could be cut in such a way as to improve the stands and to increase their output of saw-timber.

V

How Much to Take Out in Thinning

If a thinning starts with the overtopped trees it must be carried into the intermediates to have much effect on the dominants and co-dominants from which the final crop of timber is to come; but it should in ordinary circumstances not go much beyond the intermediates. The crown cover must be broken to relieve the crowding, but the stand should not be opened up too much. If it is opened up too much, the soil becomes exposed to the action of wind and sun, undesirable growth may come in, or the remaining trees may form large side limbs. The guiding thought in making a thinning is to break the cover slightly, to break it evenly, and to leave the remaining trees evenly spread over the ground at such distances that their crowns will close again in two or three years.

Expressed in terms of the number of trees standing at the time the thinning is made, in the case of young pine stands a thinning that begins with overtopped and includes most of the intermediate trees might take so many as 25% of the trees. Expressed

in terms of volume such a thinning might take so much as 15%.

In general it is safer to thin moderately than to thin heavily. In ordinary circumstances, to be on the safe side, the thinning should stop among the intermediates and not go beyond 25% of the number of trees or 15% of the volume. In exceptional circumstances the thinning might go into the dominants. A good example of this are stands of old field pine that have seeded in irregularly and have some very limby dominants. Some of the limby dominants may be taken at the first thinning, if there are cleaner stemmed co-dominants standing close enough to close up the holes in the crown cover made by the removal of the limby dominants.

VI

Thinning Mixed Stands

Stands are often composed of several kinds of tree. In mixed stands a choice may be made among the kinds as well as among the individuals and classes of the same kind, when stands are thinned. The desirability of a kind depends on its value for lumber, turpentine, posts, and ties, and its suitability to the soil. The order of preference would vary, but a general order for the Mountains and the Piedmont Plateau may be stated as follows: (1) Black walnut, (2) yellow poplar, (3) white pine, (4) loblolly pine, (5) shortleaf pine, (6) ash, (7) hickory, (8) white oak, (9) post oak, (10) red oak, and so on down to such trees as blackjack oak and black gum. A similar list for South Georgia would begin with slash pine, followed by longleaf pine.

In making a thinning in a mixed stand an effort should be made to choose between kinds so as to

weed out the less desirable kinds. When a single thinning may take 25% of the trees, it is readily seen that in the course of several thinnings the balance can be thrown toward the more desirable kinds and that in some cases all of the worthless or less desirable kinds can be cut out, leaving a pure stand of the kind most desired.

VII

The Advantages of Thinning

The advantages of thinning may be summed up as follows:

1. Firewood, fence posts, and barn poles can be had without drawing on the final crop of timber.
2. Where the market conditions are good, thinnings yield a margin of profit over the cost of making them and help the owner carry the timber crop while it is growing.
3. By keeping the trees that are to be in the final stand in a thrifty condition, thinnings bring them to merchantable size sooner than when the stand is not thinned. The time it takes to grow a crop may be shortened 10% or more.
4. By favoring the clean-stemmed, straight trees of the better kinds, thinnings improve the quality of the final crop and put the owner in a way to get a higher price for his timber.

VIII

Thinnings Should be Carefully Made

Since the wrong kind of thinning may do more harm than good, it follows that the choice of the trees to remain and those to come out should be carefully made. It is not safe to leave the choice to the ordinary hand. The owner should mark the trees before the cutting, or have them marked by one

of the hands who has sounder judgment than the rest. In marking the trees to come out such points as relative position of crown, knotty stems, crooked stems, signs of rot, the relative value of the kinds of tree in mixture, and the even distribution of the remaining trees should be kept in mind.

Some care should be had for the tops left on the ground after thinning. They should be lopped and the limbs scattered, or at least they should be dragged away from the trunks of the trees left standing.

Thinnings in pine stands should be made only during the frost months. If made at other seasons, they are liable to start an attack by bark beetles.

Owners of timberlands may apply to the State Board of Forestry for an examination of and report on their lands. Such reports treat of the condition of the timber and ways of improving it. If thinnings are advisable, the trees on sample areas may be marked to show the kinds of thinning the owner is advised to make. The only cost to the owner for such work is the travelling and living expense of the agent of the Board while doing the work.

PUBLICATIONS OF THE DEPARTMENT OF FORESTRY

Leaflet 1. The Loblolly Pine.

Leaflet 2. Forest Fire Prevention.

Leaflet 3. Report of Forest Fire Line Demonstration at Waycross, 1927.

Bulletin 1. Forest Fire Control Policy for Georgia.

Reprint of Georgia Forest Laws

Biennial Report, 1925-1926.

These publications may be had free of charge so long as the editions last, by applying to the State Forester, State Capitol, Atlanta, Ga.

SEVEN RULES FOR FOREST MANAGEMENT

1. Keep fires out of the woods.

2. Thin crowded young stands.

3. When logging, cut stumps low and use as far up the trunk as practicable.

4. Where there is a market for cordwood or pulpwood, follow logging with a cordwood or pulpwood job, to save broken small trees and stunted small trees and to rid the next stand of undesirable kinds.

5. When logging, leave two seed-trees per acre.

6. If timber does not come in evenly after logging, plant blank areas; keep the land at work.

7. Let trees reach eight inches or more breast-high before bleeding and bleed one face at a time.

GEORGIA STATE FORESTRY DEPARTMENT

B. M. LUFBURROW, State Forester

BULLETIN NO. 3

HIGHWAY SHADE TREE PLANTING

By

EITEL BAUER

Atlanta, Georgia

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A beautiful shaded highway near Atlanta, Georgia.

Highway Shade Tree Planting

Introduction

Georgia's highways are being paved at an ever increasing rate. As much as one hundred miles of continuous paving have been constructed and numerous shorter stretches of highways in the state are now paved. It will not be long before Georgia will have a system of state highways that will rank with the best. But paving a road does not make it ideal or mean the end of its development. Another step can be taken which will enhance the qualities of a paved road and endow it with life, character, and beauty. This step is the planting of shade trees along the highways—trees chosen for their natural beauty and for their influence on the road, and the

climate in the vicinity of the road. There is a great opportunity for highway planting in this state as very little has been done. And now is the time to start a program of planting that will keep pace with the completion of the highways.

Public sentiment in favor of highway planting is rapidly gaining headway in Georgia. Various Women's Clubs and other civic organizations throughout the state are interesting themselves in this commendable movement. A few miles of highways have already been bordered with shade trees but unfortunately there is no concerted action, nor any organization or individual that has the responsibility for more extensive planting.

This department has received many inquiries for information on this subject and it is the purpose of these pages to answer the questions that are asked, in so far as our information goes. Requests for information not covered in this bulletin should be directed to the State Forester, State Capitol, Atlanta.

Highway planting has been carried on for many years in northern and eastern states and a large store of information regarding their methods and results is available. But for our conditions and kinds of trees there is a woeful lack of data. European countries have had their highways bordered with shade trees for centuries but dissimilarities in the methods and species, or kinds of trees, used prevent us from having the benefit of their experience. But in spite of our inexperience we can not go far wrong if we adhere to the safe principles of using trees that are known to grow well in the locality to be planted; using care in planting; and giving the trees proper and intelligent care.

General Considerations

Planting had best be done along paved highways for several reasons. Along dirt roads every tree for a certain distance from the center of the road is cut down so that the road will dry out quickly after a rain and mud-holes will not develop. Until a highway is paved its location may be changed; but after being paved its location is permanent. If shade trees were planted along a dirt road they would have to be abandoned if the location were changed at the time of paving the road. There would be a waste of time, money, and planting stock, and the purpose of the planting would be defeated.

Shade trees can be planted beside gravel and oyster-shell roads if the roads are properly drained. Roads of these types drain comparatively fast and shade trees do a great good by preventing the roads from drying out too much and by keeping the roadbed in a better mechanical condition.

If planting is to be done on the edges of cultivated fields, although within the right-of-way, the consent of the owner of the field should be obtained. The trees will shade a portion of his growing crops, doing some damage, and the owner should certainly be consulted. From past experience it is not anticipated that permission to plant will be withheld in such cases.

Reasons For Planting

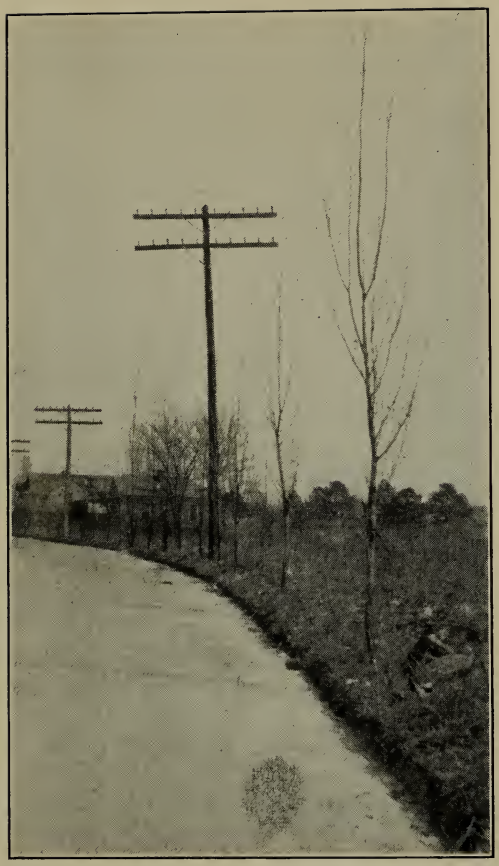
Trees are planted beside highways as much for their aesthetic effect as for their shade. Their natural beauty is a thing which is immediately apparent. The kind of tree and its physical condition influence its appreciation by travelers. Not so apparent, but more important, are the indirect effects of

their shading the road, which result in cheaper maintenance and lightening of the tax-payers' burden. Shade trees also exert an influence upon the atmosphere in the vicinity of the road. There is another reason gaining in popularity, for planting trees along a highway. Memorial plantings have increased steadily since the World War. Several stretches of highway in Georgia have been planted with shade trees as a memorial to war heroes. In some instances the entire planting commemorates some certain group—in others, a tree is planted for each soldier or sailor who gave his life.

Arrangement of Shade Trees

Because of Georgia's varied topography and consequent different types of roads no flat rule can be laid down for the arrangement of plantings. Along straight roads the trees can be planted in a row on either side of the highway—each tree the same distance from the next and the rows the same distance from the center of the road. Where there is a curve in the road the inside of the curve must be left clear or else the trees must be set back such a distance from the road that drivers may have a view of the curve. The State Highway Department of Georgia has now extended its right-of-way from eighty to one hundred feet. This additional footage is sufficient to allow shade trees to be planted on the inside of most curves found on a paved road. Very sharp curves on these roads are the exception.

On steep cuts and fills planting would probably have to be discontinued but this would be determined by the depth or height of the cut or fill. If planting should be done where cuts and fills occur the trees must not be planted on the slopes of the cuts or fills, but at least five feet back from the edge, regardless of the previous spacing.



An illustration of bad planting. The trees were planted barely one foot from the edge of the pavement, placing it in danger of being cracked by the roots. In another year the branches of the trees will grow into the wires making it necessary to cut the trees off squarely.

If the highway is very winding a better arrangement than planting in rows is planting in groups. With a little care given to the placing of the groups vistas can be opened. Planting in groups will better suit the conditions and also have a more natural appearance.

A large proportion of state highways are through wooded areas. In these places very little, if any,

planting will be necessary. Trees of good kinds and spaced about right can be developed to make very satisfactory shade trees.

One objection to planting in rows is that the effect is artificial, and another is that several miles of such planting would become very monotonous to travelers. But these objections are met, for the most part, by the trees themselves. No two of them will grow at the same rate or in the same manner and the difference between individuals will furnish more than a little variety. Some trees will die and gaps will appear at irregular intervals making the planting still less artificial. Using a mixture of species will also help to dispel these objections.

Kinds of Trees for Highway Planting

The choice of the species or kinds to be used is determined by many factors among which are altitude, moisture, and soils. In general, it is best to use the species that grow naturally in the locality to be planted. One would not plant a hemlock or other mountain tree near Savannah. It is often possible to use trees that are growing naturally by the highway, approximately properly spaced and of a good kind. It is hoped that trees native to Georgia will be most widely used. Georgia has a very wide variety of shade trees and it should not be necessary to introduce strange species. In the following list a few outstanding species not found growing naturally in Georgia are mentioned. These are recommended because of their very desirable qualities. There are many other species which can be used but the list is composed of those trees especially suited for shade, longevity, freedom from disease, and because of their aesthetic qualities.

Lower State—Coastal Plain Region

	Deciduous*	Evergreen
Low, damp, Swampy Places	—Water Ash Water oak Willow oak	Magnolia White Cedar Palmetto Spruce (swamp) Pine Live oak Laurel oak
Upper Drier Places	—White oak Water oak Crepe myrtle Dogwood Sycamore Hackberry Scaly-bark Hickory Pecan Willow oak	Longleaf pine Red cedar Magnolia Live oak Laurel oak

Middle State—Piedmont Region

Low, Moist Places	—Black Walnut Tulip tree Water ash Basswood (Linden) Dogwood Silverbell Scaly-bark Hickory Willow oak	Red cedar Magnolia Loblolly pine

*Deciduous trees are those which drop their leaves every year. Evergreen trees retain their leaves for several years.

Moist Slopes	—Black walnut Water oak Sycamore White oak Willow oak White elm Pin oak Pecan Dogwood Crepe myrtle	Red cedar Magnolia Loblolly pine
Dry Ridges	—Willow oak Southern red oak Pin oak Pecan Dogwood Crepe myrtle	Red cedar Loblolly pine Shortleaf pine

Upper State—Mountain Region

Moist Coves	—Black walnut Tulip tree Beech Basswood (Linden) White ash Silverbell Willow oak	Hemlock White pine
Lower Slopes	—White elm Northern red oak Water oak Pin oak Sugar maple Beech Dogwood White oak	White pine Red cedar Norway Spruce

Upper Slopes	—Northern red oak Chestnut oak White oak Dogwood	White pine Red cedar

NOTES ON KINDS OF TREES RECOMMENDED FOR HIGHWAY PLANTING

Ash—Water (Fraxinus caroliniana and F. floridana)—Native to the swamps and ponds of the Coastal Plain. Attains a height of 40′ and a diameter of 1′-2′. Its small flowers appear in February and March. Forms a narrow, round-topped head.

White (F. americana)—Native to the coves and river bottoms of the northern half of the state. A tree sometimes 80′ high and 2′ in diameter. Forms, in the open, a round or pyramidal crown. Very good for shade tree planting.

Basswood—American Linden (Tilia americana)—Found in the rich, alluvial bottom-lands in the northern part of the state. Is often 100′ high and 3′ in diameter. Forms a large crown, giving a deep shade.

Beech—(Fagus grandifolia)—Found in the northern part of Georgia along the lower slopes. When grown in the open is short-stemmed—usually about 50′ high—with a large, spreading, round crown, the branches slightly drooping. An excellent shade tree.

Cedar—Red (Juniperus virginiana)—A well-known tree found throughout the state and thriving on a variety of soils. Is much in use for ornamental planting. Living specimens are often used for community Christmas trees. A good tree for memorial planting. Cannot be planted in the vicinity of an apple orchard.

White (Chamaecyparis thyoides)—Found only in deep swamps and ponds in the Coastal Plain Region. This tree has a long, narrow, conical shape even when grown in the open. In groups or rows they are very picturesque.

Crepe Myrtle (Lagerstroemia indica)—An introduced plant very much in demand for drives, avenues, etc. The

flowers are red, white, or pink, according to the stock. A very pretty tree wherever planted. Can be used in combination with other planting.

Dogwood—Flowering (Cornus florida)—Found throughout the state. Grows best in the shade of other trees. Its profusion of white flowers are a beautiful sight in the spring. The drooping, spreading crown gives a delightful shade.

Elm—White (Ulmus americana)—Distributed infrequently in Georgia but planted extensively for park and street shade trees. A longlived majestic tree with lofty arching branches, forming an enormous crown. Justly famed for its shade.

Hackberry—(Celtis occidentalis)—Reaches its best development in the southeastern part of the state but is found on all varieties of soils. Planted for street shade trees in many towns. When grown in the open the crown is very symmetrical.

Hemlock—Eastern (Tsuga canadensis)—A beautiful conifer found in the coves and cool slopes of the mountains where it often reaches a height of over 100′ and a diameter of 3′ or more. Its pyramidal form makes it a very desirable tree for shade and ornamental purposes.

Hickory—Scaly-bark (Carya ovata)—Native to rich, damp soils throughout the state. Besides its worth as a shade tree, it is also valuable for its sweet, well-flavored nuts. This tree would serve a dual purpose when used in highway planting.

Magnolia—(Magnolia grandiflora)—One of Georgia's best known and loved trees. Is indigenous to low-lying damp places in the Coastal Plain but is planted through most of the state for shade and ornament. Its evergreen foliage and white blooms form a beautiful combination.

Maple—Sugar (Acer saccharum)—Not a native of Georgia but is extensively planted as a shade tree. It is better suited for this purpose than the other maples because it is longlived and not so liable to damage from insects, disease, or breakage. The rich tints of its autumnal foliage are very pleasing.

Oak—Chestnut (Quercus montana)—Found in the mountainous part of the state as far down as the higher foothills. It attains a height of about 60′ and forms a spreading crown, making an excellent shade tree.

Laurel (Q. laurifolia)—A tree native to rich hummocks and the sandy banks of streams in the lower Coastal Plain Region. Occasionally 100′ high with a diameter of 3′-4′. Has a shapely broad, dense, round-topped crown. The persistent lustrous green leaves help to make this a very handsome shade tree.

Live (Q. virginiana)—Indigenous to the lower Coastal Plain Region. This tree is well-known for its shade and ornamental properties. It forms a wide-spreading crown often over 100′ across and a massive, buttressed trunk. As the leaves do not fall until new ones appear it is evergreen in appearance.

Pine (Q. palustris)—An introduced tree rapidly gaining favor for shade planting. It is rather slow-growing after transplanting but soon starts its more rapid growth. It attains a height of 40′-50′ and a diameter of about 2′. Forms a large round-topped crown.

Red—northern (Q. borealis)—Native to the northern part of the state. A valuable forest tree and equally desirable for its shade. Often reaches a height of 80′ and when open-grown forms a wide-spreading rounded crown.

Red—southern (Q. rubra)—A common oak in the Piedmont Region. It grows to a height of 70′-80′ and a diameter of 2′-3′. Is well-suited for a shade tree because of its handsome appearance, freedom from disease, and long life.

Water—(Q. nigra)—A well-known Georgia tree found throughout the state on all except the driest soils. Very much in demand for city street planting and as a lawn tree. Is easy to transplant and grows thriftily. An excellent shade tree.

White (Q. alba)—Another well-known tree found throughout the state. Individual trees attain an immense growth in girth and crown and there are many magnificent specimens of this tree in the state. Although of relatively slow growth it is very valuable for highway and street planting.

Willow (Q. phellos)—A tree found in all but the northern part of the state. Often grows to a height of 70′-80′. Has light-green, slender, willow-like leaves. Forms a spreading, round-topped head and is admirably suited for shade purposes for which it has been widely used in yards and along streets.

Palmetto—Cabbage (Sabal palmetto)—An inhabitant of the lower Coastal Region. Reaches a height of about 30′ and a diameter of 1′-2′. Its outward curving and drooping fan-shaped leaves are very picturesque. An excellent tree for memorial planting.

Pecan—(Carya pecan)—Native to the southern half of the state. It is best known for its fruit, of which there are several very good varieties, but also makes a desirable shade tree. It would serve a dual purpose in highway planting.

Pine—Loblolly (Pinus taeda)—This tree, also known as Old-field Pine, is found in the Piedmont and upper Coastal Plain Regions of Georgia. Will grow to a height of about 100′ and a diameter of 2′-3′. Has rather long slate-green needles. When open-grown forms an oval crown with limbs reaching almost to the ground. A fast-growing pine.

Longleaf (P. palustris)—A well-known pine in the Coastal Plain Region where it is valuable for timber and naval stores. Reaches a height of over 100′ and when grown in the open has a rather open crown extending over half the length of the tree. Its long needles and purple flowers on new spring shoots make this a handsome specimen tree.

Shortleaf (P. echinata)—Found throughout the Piedmont Region of the state. A valuable timber tree but of relatively slow growth. Often grows to a height of over 100′ The needles are short and dark blue-green. Forms a pyramidal crown.

Spruce (P. glabra)—Found widely scattered among the hardwoods in swamps and ponds in the lower Coastal Plain Region. It resembles the white pine of the mountains. Would make a good tree for highway planting along marshy stretches.

White (P. strobus)—Indigenous to the Mountain Region of the state where it is found on a variety of site conditions from cool moist coves to dry rocky ridges.

Extensively handled by ornamental nurseries as shade trees and specimen plants. Is very desirable for highway planting. Suggested for memorial plantings.

Silverbell (Halesia carolina)—A not-very-well-known tree of the northern and especially the mountainous part of the state. Grows to a height of 50′-60′ and a diameter of 1′-3′. It gets its name from the pendent rows of white flowers appearing in the spring before the leaves are fully developed. This tree should be better known for shade planting.

Spruce—Norway (Picea excelsa)—An introduced species in the Mountain Region where it thrives in cool, moist situations. It reaches a height of 60′-80′. The crown is pyramidal in shape, the lower branches almost sweeping the ground.

Sycamore—(Platanus occidentalis)—Occurs throughout the state. It often grows to a height of over 100′ and a diameter of 4′-6′. Its branched trunk and spreading crown make this a desirable shade tree. The European sycamore is also planted for shade and is a better tree for this purpose because of its resistance to disease.

Tulip Tree—Yellow Poplar (Liriodendron tulipifera)—A valuable timber tree found throughout the state. Reaches a height of over 100′ and a diameter of 3′-5′. When grown in the open it forms a large, rounded, spreading crown. Its odd-shaped leaves and beautiful tulip-like flowers make this a very attractive tree. It is being more widely planted for shade and ornament.

Walnut—Black (Juglans nigra)—Found in the middle and northern parts of the state in rich, moist bottoms particularly. Well known for its use in the manufacture of furniture. The nuts are extensively used in confections. When open-grown this tree has a short, thick stem and a wide-spreading crown. A good tree for memorial planting.

Size of Trees to Plant

For best results from the planting the trees used should be very small. It is better to use small plant-

ing stock and have a successful planting than to try for an immediate effect with large trees and possibly lose as many as half of them.

The size of the trees to use is dependent upon the kind. A few characteristic trees are mentioned to show how this works out, and to give an idea of the size trees to use, taking the trees mentioned as indicative of all trees coming in their classification. For instance, white pine and Norway spruce are representative of ornamental conifers; pines, of coniferous forest trees; and oaks, of trees with long taproots.

Oaks, walnuts and other trees having a long taproot should not be over a year old when transplanted. Because of the difficulty in lifting them, even when only a year old and the trouble of handling trees of this kind it may be a better idea to plant seed in the desired places.

Magnolias and live oaks, both broadleaved evergreens, should be very small when transplanted. Results will be better if they are only a foot high. The roots must be disturbed as little as possible and preferably balled.

The water oak and practically all the fibrous rooted deciduous trees such as the dogwood can be moved in any size up to about ten feet in height.

Of the conifers mentioned, longleaf pine should not be planted when over one year old. This tree develops an enormous taproot during the first few years of its life. It may be best to plant seed in the desired places, putting from three to ten seed in each spot. The other pines can be planted up to three years of age. These forest pines do not require a ball of earth around their roots but the roots must be kept moist and protected from sun and wind.

White pine over three years old, hemlock, and Norway spruce, should not be over three feet high when transplanted. They must have a ball of earth around their roots.

Red cedar and white cedar can be transplanted in any size up to about five feet in height. It is better to have the roots balled but not absolutely necessary if the roots are kept moist and the trees are transplanted immediately.

Small planting stock should be used in all cases, if possible. Smaller trees can be bought for considerably less than larger trees. And whether the trees are from a nursery or from the woods, the smaller ones stand a better chance of being successfully transplanted. There is danger, also, in using stock that is too small. The trees should be about one foot high at least.

Where to Obtain Trees

Some of the trees in the list are handled by ornamental and forest nurseries. Nursery-grown trees should be used wherever possible. Nurseries can furnish better looking and healthier stock than is generally found growing wild. The trees will be pruned at the nursery before being delivered and this operation will be spared the planter. Nursery stock can be lifted from the ground with less injury to the plants than can wild stock. The charge made for trees by the nursery is very often cheaper than the time spent in locating wild stock.

For some of the kinds of trees there is no choice because they are not enough in demand to be grown in nurseries and wild stock must be used. Wild stock must be pruned before being re-planted. The following directions for pruning apply to wild stock especially.

Pruning

Pruning is very necessary at the time of transplanting. The root system of the plant is generally unavoidably injured and reduced. To induce rapid healing, the bruised and injured roots should be cleanly cut just above the injury. The crown, or branches of the tree, must be cut back to preserve its balance with the decreased root system. The crown can be shaped by proper pruning.

Fig. 1. Diagram showing proper pruning of the crown and roots. The heavy marks in "a" show where pruning should be done. Note the rounded shape of the pruned crown in "b".

By shaping the crown at this time and starting it right, the tree is given a better appearance and less trouble will be had with its form later.

All cuts should be made close above a bud, and it

is preferable to make the cut at a bud which will start a shoot in the desired direction.

Fig. 2. Diagram showing how cut should be made in pruning branches. By making the cut close above a bud no stub is left to rot and endanger the tree.

Fig. 3. Diagram showing how the choice of the bud left determines the direction of future shoots. Heavy marks show where cut is made. Dotted lines indicate future shoots.

Branches which are removed should be cut as close as possible to the stem. No stubs should be left. The decay of stubs left from pruning offers an entrance to insects and diseases and is often the

cause of cavities. No cuts should be made horizontally, but always on a slant so that water will not collect on the exposed surface.

Any leaves remaining on broadleaved trees, either deciduous or evergreen, when they are transplanted should be removed.

Spacing

The trees should be set at least ten feet from the edge of the road. This does not mean from the edge of the pavement but from the edge of the shoulder, or dirt strip, that is left on either side of the paved area. At this distance the large spreading roots of some trees will not be able to damage the paving The distance between the trees varies with the kinds. Some trees spread their branches more than others and require more space in which to develop The live oak often spreads its branches over an area 100 feet or more in diameter while the silverbell may never have a diameter over forty feet. As a general rule, the distance between trees should never be less than twenty-five feet. For some of the larger-growing kinds of trees forty or fifty feet would be a better spacing.

Planting

The success of the undertaking is largely assured by the care used in planting the trees. Planting can be done from the first of November until the last of March, depending upon the locality. In the extreme southern part of the state planting should be done only in January and February.

Good, healthy, well-shaped stock should be used. There should be a minimum of time between obtaining the stock and planting it in the desired places. The roots should be kept shaded and moist

and protected from the sun and the wind while the plants are out of the ground. Wet burlap or crocus sacks are excellent for protecting the roots.

The hole dug for each tree should be a little larger than necessary to accommodate all the roots without the least crowding. The extra expense of large holes is more than compensated for by the results. It is better policy to plant a few trees correctly than to plant a large number in a haphazard hurried way. When the holes are dug the topsoil should be set aside and mixed with well-composted stable manure. This mixture is put in the bottom of the hole and covered with a light layer of fresh earth to prevent the roots coming in contact with the manure. The hole is now ready for planting.

If possible, two men should plant each tree, one to hold it in the proper position and the other to tamp the earth around the roots. It is assumed that the tree, if a conifer, has a ball of earth around the roots. The best side of the plant is turned toward the highway and the plant lined in with the others and spaced correctly. The plant is set in the hole so that the entire ball will be covered with earth but the plant must not be set over one inch deeper in the ground than it was before transplanting. For best results plants should be set at least as deep as they were before being moved. This depth can

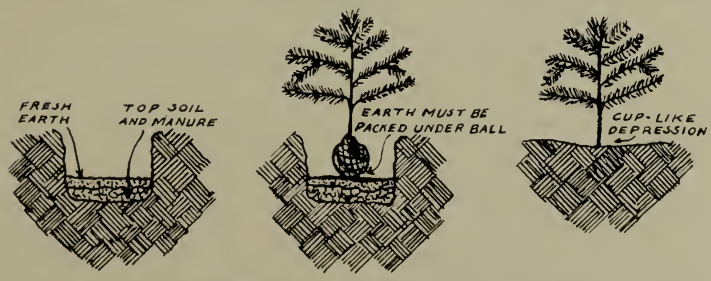


Fig. 4. Diagram showing the preparation of the hole and the method of planting conifers.

easily be seen from the discoloration on the stem of the tree. Earth must be packed around the ball and under it so that no large air spaces are left. The handle of a D-handled spade is well suited for tamping. When the hole is about three-fourths full of packed dirt enough water to fill the hole should be poured around the plant. When this has soaked down, the hole is filled with earth. The surface should be left cup-like with the stem of the tree as the center of the depression. This is done so that rain water will be guided against the plant where it is needed.

In the case of deciduous trees the crowns and roots must be pruned (see Pruning). The hole is prepared in the same manner as for conifers. The tree is set in the hole not over one inch deeper than it was before being moved. Care must be taken to see that the roots are kept in their natural position and not bent, curled, or twisted to fit the hole. The

Fig. 5. Diagram showing the preparation of the hole and the method of planting deciduous trees.

hole should be made to suit the tree. Earth must be packed around each root. Water is added in the same way as for conifers and the rest of the treatment is the same.

After a day or two every tree should be visited and the earth around them firmed by stepping on

it, at the same time keeping the tree in an upright position. They should not lean in any direction.

Care After Planting

Probably of more importance than planting is the care of the trees after planting. Very often people think that when they have planted a tree their responsibility ends. In spite of the most careful planting some trees will die and it will be necessary to fill in the gaps that form from time to time to keep the planting complete.

Insects and diseases are always waiting to attack trees that are bruised or injured in any way that will give them an opening. For this reason the possibilities of injury to the trees by stock must be considered before a planting is made. Space is lacking in this pamphlet for descriptions of and remedies for the insects and diseases that are liable to attack the shade trees mentioned. (This information may be had by a request to this department or to the State Entomologist).

Dead wood and branches must be cut out of the shade trees to improve their appearance and to remove a source of danger to traffic.

Pruning of deformed branches and lower branches will be necessary. Lower branches obstruct the view, are dangerous to traffic and their removal will stimulate height growth. They also often interfere with cotton and hay traffic, the twigs becoming decorated with these products, giving the tree a shabby appearance. Branches which interfere with wires must be trimmed.

Living branches should only be cut when it is absolutely necessary to do so and the wound painted with creosote or some other material impervious to water.

As the trees grow older some cavities will form and tree surgery will be necessary.

It has been stated that there are few organizations which have responsibility for planting and there are none which have the responsibility of upkeep. It has been suggested that the upkeep and care of the shade trees be handled by the State Highway Department. Being planted on the right-of-way of the highway department the trees automatically come under the control of that department in so far as they affect the highway. At present the Highway Commission does not take care of shade trees along the highways, nor does its organization include any means for doing so. The following organization has been proposed.

The state would be divided into several districts and a man who understands the care of trees would be stationed in each district. He would have the power of a foreman and would command road crews not engaged in highway maintenance to do improvement work on the shade trees, under his direct supervision. He would be furnished with a light truck equipped with tools for trimming, pruning, spraying, etc., for a four or five man crew and would travel in his district as the work demanded. He could time his movements to coincide with section crews that would otherwise be idle. The men chosen for the districts should be men who have a practical knowledge of the care of trees. The trees can easily become eye-sores and be terribly injured by ignorant and careless handling.

In some of the New England states the care of highway shade trees has been undertaken by the state highway departments for many years and the work has been handled very satisfactorily.

Results of Planting

The chief result of planting shade trees is the beautification of our highways. Shade trees are a source of constant enjoyment to residents and an inducement to visitors to remain in the state. Tourists will wish to stay longer in such surroundings and will have a different story to tell of Georgia's highway system.

The presence of the trees and their shade tend to create a more even moisture condition along the road. Because of the ramifications of the root systems the soil adjacent to the road is better drained. Water will not collect to form mudholes. Dust will be held down because the earth will never bake and fully dry out and the force of the wind will be broken to some extent.

Better moisture conditions mean a better condition of the roadbed, entailing less maintenance. This means a direct benefit to tax-payers.

A cleaner, purer atmosphere along the highways will be a result of shade trees. The exact relation of trees to atmospheric conditions has never been fully determined but it is known that the presence of trees tends to prevent sudden and extreme atmospheric changes. The trees seem to exert an equalizing influence on temperature and humidity. While only a double row of trees will not have a marked effect in this way, their influence will surely be felt.

Shade trees furnish a beautiful permanent memorial to our soldiers and sailors who gave their lives for their country. The deep shade and rugged beauty are peculiarly suited for such a purpose.

Many native and migratory birds will be attracted to the highways and roadsides where they will be

an added pleasure to travelers. Under present conditions, except in wooded stretches, birds are seldom seen or heard near the highways.

Where trees such as pecans, hickories, and walnuts are planted the nuts would be available for the public, or at least it is hoped so.

Costs of Planting

There are no available data on the cost of planting shade trees along highways but a rough estimate can be made, assuming a price for the transplants. Figuring on the cost of the stock, handling it, preparing the hole, and planting, the cost would vary from about one dollar to four dollars or more per tree. The kind of tree, its size, and the distance it has to be taken to be planted all directly affect the cost. If the planting is for memorial purposes the cost of placing suitable markers must be added.

Planting in Other States

In Massachusetts the State Highway Commission has authority over all planting, trimming, cutting, and removal of shade trees on its right-of-way. Since before 1899 laws relating to shade trees have been enforced. Tree wardens have been appointed to take care of shade trees not under the jurisdiction of the highway department. A great deal has been accomplished toward planting shade trees and caring for them.

Since 1922 New Hampshire has had laws protecting highway trees and serving as inducements for such planting. Many miles of memorial highways have been dedicated since the Great War. Trees planted along the highways are deeded to the highway department and the wood is reserved for the

use of the owner of the abutting property if the tree is removed at any time.

The movement toward shading the highways has progressed along lines similar to these in many other states throughout the country.

Recommendation

Planting shade trees along Georgia highways is highly to be recommended because of both the direct and indirect results of such planting. It is hoped that one or more public-spirited organizations in each community will sponsor this movement and help beautify the highways of the state. Before a planting is done provision should be made for the care of the trees after planting, as it becomes necessary. This department is willing to help the movement toward highway shade tree planting in any way possible for it to do so.

Summary

1. Public sentiment in favor of highway shade tree planting is growing in Georgia.
2. Planting should be confined to paved highways.
3. Owners of abutting property should be consulted before a planting is made.
4. Trees are planted for their shade, beauty, effect on climatic and road conditions, and as memorials to our war dead.
5. Trees may be planted in rows or groups at least ten feet from the edge of the beaten road and at least twenty-five feet apart.
6. Planting on the inside of curves must be set back to give motorists an unobscured view of the curve.
7. Native Georgia species should be used if possible, especially trees already on the ground, of good kinds, and approximately properly spaced.
8. Large trees should not be used for best results. Trees one foot in height or less do best. Deciduous trees should be pruned, roots and branches. Conifers should have a ball of earth around their roots.
9. Care must be taken in the preparation of the holes and the actual planting of the trees.
10. Care after planting is as important as planting, or more so.
11. It is suggested that the care of the trees be the responsibility of the highway department.
12. Costs are affected by the kind of tree, its size, and the distance it must be taken to be planted.

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Georgia Forest Service

B. M. LUFBURROW, State Forester

FOREST PLANTING

By

EITEL BAUER

Atlanta, Georgia

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Forest Planting

By EITEL BAUER

INTRODUCTION

Georgia's large forest area is composed of lands in saw-timber, in second-growth and abandoned farm land beginning to revert to forests. The care of these forests is of prime importance, but reforestation of idle lands is also of vital concern.

Natural seeding, artificial seeding or sowing, and planting small trees are the main methods of reforestation. Natural seeding takes place to such an extent in the South that the necessity for artificial planting is confined to a comparatively small area.

Some conditions which make planting advisable are: (1) Where natural reproduction does not occur because of the absence of seed-trees. (2) Where natural reproduction is incomplete or irregularly spaced. (3) Where undesirable kinds of trees are coming in. (4) Where it is cheaper to plant than to leave seed-trees—that is, if the value of the seed-trees as timber is greater than the cost of planting. (5) When it is not desirable to wait for natural reproduction.

POINTS TO CONSIDER

Planting is not advised if the area to be planted is not to receive protection from fire. A light fire in a young stand may completely destroy it and the investment become a total loss. The age at which trees can survive a fire depends on the kind of tree. For instance, long-leaf pine can survive a light fire when three years old, while slash pine up to eight years of age may be killed outright in the same fire. In older stands, though the trees are not killed, fire checks growth. The result is the same as if the planting had been delayed several years. The annual cost of fire protection is very small, seldom over five cents per acre, and may be less for large areas.

KINDS TO PLANT

The kinds of trees to plant is determined by the locality, soil and moisture conditions of the land, and products desired. The products desired also determine spacing in setting out trees.

The locality plays a large part because of the restricted range of some of the best forest trees. In the mountain and upper Piedmont sections of Georgia hardwoods predominate. Here can be planted black walnut, white and red oak, yellow poplar, hickory, white ash, and black locust, to mention some of the more valuable trees. White pine, shortleaf pine and hemlock are native to that part of the state and can also be used. Chestnut blight (Endothia parasitica) is steadily advancing over the country until now it appears every chestnut tree is doomed. As no remedy or preventive has yet been found for this disease it is not advisable to plant chestnut which otherwise would be a very desirable tree to grow.

Along the streams and bottoms of the lower Piedmont section black walnut, white oak, yellow poplar, red gum, hickory, and ash are good trees to plant. On the slopes and ridges loblolly pine and shortleaf pine grow naturally and plantings of these two species should be successful. Loblolly pine is better than shortleaf pine as it can be grown and harvested in a much shorter period.

In the lime-sinks, ponds, and river and creek swamps of South Georgia, cypress, red gum, yellow poplar and ash are suitable for planting. But in that region the most extensive plantings should be to slash pine and long-leaf pine, both of which form the native piney woods, the source of naval stores and high-grade pine lumber. Of these two, slash pine is the more desirable because of its faster growth, especially during the first 30 years, and because of its slightly larger yield of naval stores.

As indicated, the moisture conditions of the soil have a direct effect on the kinds of trees the land will best support. In general, conifers, except hemlock, do better on a relatively dry,

well-drained soil and grow thriftily on dry, sandy land; whereas hardwoods do best on a heavier, moister soil. Soils worn out in growing farm crops will support a good growth of trees, but better soils will produce a quicker growth and a better quality of timber. With few exceptions, forest trees will not thrive where drainage is very poor.

SPACING

The spacing to use in planting depends on the products desired. If fence posts are desired, white oak, pine, black locust or osage orange can be planted, and spaced rather close, 5x5 feet, for example. For ties, the trees used may be oak, pine or cypress, and the spacing more than for posts as diameter growth is wanted rather than height. Pines, cypress and sometimes oak are used for poles. In this case spacing should be close, about 6x6 feet to stimulate height growth. Trees for lumber are spaced to give the best opportunities for both height and diameter growth. Spacing for this purpose should not be less than 6x6 feet and may be as much as 8x10 feet.

The spacing to be used in growing pines for gum production is being studied. There are no reliable figures for longleaf pine, but recent studies in slash pine indicate a spacing of 6x8 feet as ideal for a young plantation.

SEEDING

Despite disadvantages of seeding land directly, this method is occasionally used so it is well to know how this is done.

For broadcast seeding the ground may be prepared by plowing or by merely clearing the ground of vegetation that would keep the seed from making direct contact with soil. Conditions are seldom favorable for plowing.

When the ground is prepared a still day preceding or following a rain is chosen to sow the seed so the wind will not cause the seed to be distributed unevenly. The seed are sown in the same manner as rye or oats and covered by lightly raking the ground.

The best method of direct seeding is to plant the seed in

spots. Where conditions permit, furrows are made the desired distance apart with a disc turn plow. At regular intervals in the furrows the earth is smoothed. From three to ten seed are dropped in each spot and covered with earth, the depth of the covering depending on the kind and size of the seed.

When not practical to plow furrows seed-spots can be made with a mattock or hoe. A small area about a foot in diameter is worked thoroughly. The seed are then placed in it and covered with earth.

By using seed-spots the seed receive some degree of protection, more so than if they are broadcast over the surface. The trees will come up properly spaced. Better germination is assured as the seed are placed directly in the soil. Fewer seed are needed per acre, reducing the cost.

With a few kinds of trees, seed planting is preferable to seedlings for reforestation. This is especially true of trees which develop a long tap root, making transplanting unsafe and difficult. Such trees are black walnut, most of the oaks, hickory and black locust.

WHERE TO GET SEED

Seed can be collected from living trees or bought from seed dealers. Seed collecting is done in the fall as the seed ripen. Methods of collecting vary with the kinds of seed. Pine seed can best be secured by following a logging operation just before the cones, or burrs, open in the fall, and taking the cones from the fallen tops. Collecting cones from standing trees is a slow, expensive process. The cones are spread on canvas in the sun or on a tight floor where they will receive some heat, and as they open the seed will fall out. Any seed remaining will drop out if the cones are tapped sharply.

The seed are then cleaned of their wings by being placed in a sack and flailed, or by being rubbed over a screen that will just permit the seed to pass through the meshes. By slowly dropping the flailed seed in a current of air such as high wind or produced by an electric fan, the broken wings, chaff

and light worthless seed will be blown away, leaving good, clean seed.

Nut or acorn-bearing trees, drop their fruit in the fall and it can be gathered at that time. Ash seed matures in late summer and must be secured before it is scattered by the wind. Large pieces of canvas spread under the trees will catch most of the ash seed. Yellow poplar seed may be gathered by climbing the trees and securing the seed between the middle of September and the last of October. Ash and yellow poplar seed need not be cleaned of their wings.

When the seed are not to be planted until spring they must be stored over winter. Methods of keeping seed in good condition vary with the kind of seed. Pine seed can be kept in air-tight mason jars or carboys. Ash and yellow poplar seed can be kept in sacks in a cool, dry place out of the reach of rats. Nuts and acorns are stored by stratification. A pit is dug and a layer of seed spread in the bottom. These are covered with a layer of equal depth of sandy earth. Another layer of seed is put down, then a layer of earth, until all the seed have been stored. Nuts and acorns can also be stored in a dry cellar by using the same method as for a pit.

WHERE TO GET TREES

"Wild stock" is the name given to trees growing naturally in the woods or fields. This type of planting stock is often used but is generally more expensive than nursery-grown trees because of the time required for locating the plants in the forest and the poor results obtained from transplanting. Wild stock suffers greatly when transplanted, and even with utmost care, it has a high percentage of fatality in comparison with nursery stock. Some very successful plantations of pine, though, have been started with wild plants taken from old fields and open woods. Pines growing naturally in old fields are better suited for transplanting than those growing in woods as the latter are apt to lack in vitality.

For best results, however, trees should be started in nursery beds and set out in their permanent location when one or

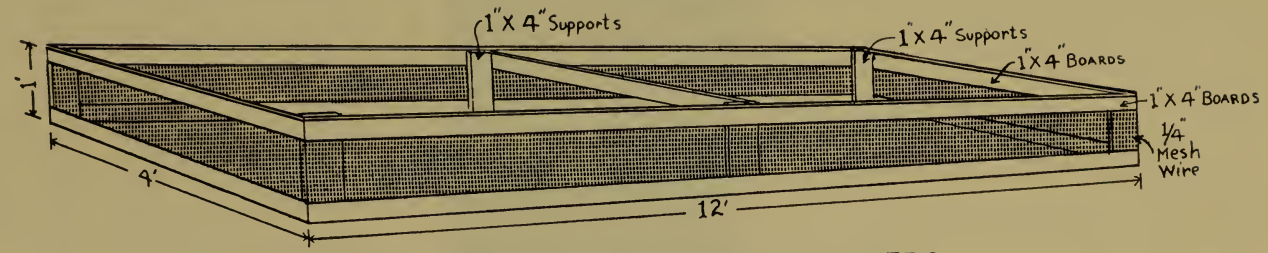
two years old. Nursery-grown trees may be obtained from the Forest School Nursery, Athens, Ga., and from commercial nurseries which handle this class of stock or they can be grown in home nurseries. Most of the forest planting stock in the South has been grown in the past in private nurseries operated by lumber companies or timber owners, but as the demand for forest trees increases, commercial nurseries will give more attention to it. Where only small quantities are needed trees can be grown in a home nursery.

HOME NURSERY

Very little space is required to grow a few thousand trees for transplanting. A light, well-drained soil that stays fairly moist is best for a nursery. Any ground is suitable that will make a good garden, and the preparation of the soil is the same as for a garden. The more the soil is worked and pulverized the better will be the results. Sticks and stones should be eliminated as much as possible.

The area is laid off in beds and walks. A convenient size for the beds is 12 feet long by four feet wide. The walks should be slightly lower than the beds and not over three feet wide. Frames are made for the beds to prevent the soil washing away and to protect the seedlings.

In Georgia the best season to sow seed is early in the spring from February 15 until April 30, the earlier date in South Georgia and the later date in the mountainous part of the state. Pine seed are sown evenly over the bed or in drills not less than six inches apart. Either way is permissible but the latter is better as it permits easier and safer removing of the trees and makes weeding easier. When broadcast the seed are covered by sifting a layer of sand or light, fresh earth over them. The depth of the covering depends on the kind and size of the seed. Hardwood seeds are spaced farther apart, the rows seldom being closer than ten inches. The ideal time to put seed in the beds is just before a rain. It is important that the beds be kept moist, not wet, until the seed germinate. Wet



SIMPLE TYPE OF FRAME FOR SEED-BEDS

The materials necessary for the construction of the seed-bed frame of 4x12 feet, consists of four pieces 1x4 inches, 12 feet long; five pieces 1x4 inches, 4 feet long; six pieces 1x4 inches by 12 inches and 32 feet of 1-4 inch mesh wire or smaller mesh. The diagram given above gives all specifications as well as plans for construction. From 2,000 to 4,000 pine seedlings can be grown in a 4x12 frame; and from 400 to 1,500 hardwood seedlings.

burlap or crocus sacks can be laid over the beds but they must be removed as soon as the seedlings appear.

During the first year the seedlings should receive half shade only. With oaks this is not necessary. Lath screens are used to shade the beds. The screens are made in sections, each four by four feet. The laths are spaced the width of a lath apart to give half shade. Wire screens are often necessary for the protection of the seed and seedlings from birds and rodents.

When the seedlings are about an inch high they must be thinned out so that they will be about an inch apart in the

Forest Nursery—Front bed shows half-shade covering.

rows. The beds will have to be weeded frequently. They must never dry out. In ordinary seasons watering may not be necessary but provisions should be made for watering the beds during very dry periods.

The frames must be kept in good repair and the screens in place to keep rabbits, birds, dogs and squirrels away from the seed and seedlings. Moles can be checked with traps, or by digging a narrow trench around the beds and filling it with lime.

The production capacity of beds 12x4 feet is determined

by the kind and amount of seed sown. From four hundred to fifteen hundred hardwood seedlings can be grown in one bed. Pine seedlings do not require as much space and from two to four thousand can be raised in a bed. From one-quarter to one and a half pounds of pine seed, depending on the species of the seed, are necessary to sow one bed 12x4 feet. About one-third of a pound of ash seed will sow one bed and about one-half pound of yellow poplar will seed a bed and one-half to a pound of acorns.

Most seedlings can be set out the fall after they are started in the nursery. Under some circumstances it is best to wait until the following spring. Some trees, like white pine, transplant best when two years old. The seedlings may either be left in the beds or after the first year taken from the beds and planted about three inches apart in rows eight or ten inches apart. From these rows the next year they can be transplanted to their permanent location. Seedlings being removed for planting in the fall leave the beds available for sowing again the next spring.

After a bed has been in use for three consecutive years it is well to grow a green crop to turn under. Seedlings require very little fertilizer, but a small amount of well-composted stable manure, free from weed seeds, worked into the soil every two years is beneficial. When this is done green crops are not necessary.

PLANTING

The best time for planting seedlings is in the fall. Many advocate spring planting but fall planting is to be preferred in this state because the growing season continues until late in December. During this fall growing period the seedlings become established and are ready to make rapid progress in the spring. Over most of the state there is practically no danger of the seedlings being heaved from the ground by freezing. In localities where there is danger of heaving it is better to plant in the spring.

When seedlings are taken from the beds or nursery rows

they must be handled carefully to prevent injury to the roots. The seedlings should be tied in bunches of fifty or one hundred and placed in buckets of water or covered with wet sacks. As soon as possible they should be taken to the scene of planting and heeled-in if they are not to be planted immediately. Heeling-in consists of digging in shaded, moist soil a V-shaped trench about six inches or a foot deep, depending on the size of the roots, and placing the bundles of plants in the trench

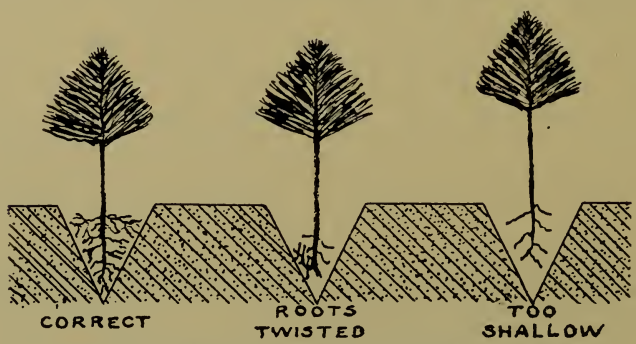


Diagram showing correct position of seedling in the ground

so that the roots and about half of the plants will be covered with earth. The ground is then firmed around them. The bundles are taken from the ground as needed. When removed the bundles are cut loose and the seedlings put in a bucket of water thickened with mud or clay. This is called puddling the plants. The thin mud forms a protective covering for the roots. From this bucket the seedlings are placed directly in the plantation.

The ground needs no preparation for seedlings. If the planting is on abandoned farm land the rows can be laid off by plowing furrows the desired distance apart and the trees planted at regular intervals in the furrows. Under most conditions plowing is impossible and a hole must be made for each tree. Plowing furrows is less expensive than making individual holes. In very brushy land an area about four feet in diameter can be cleared around each tree to prevent its being shaded out.

Holes for trees can be made with grub-hoe or mattock.

The holes do not have to be large; just wide enough to spread the roots in their natural position and deep enough to allow the plant to be set a little deeper than it was in the nursery. Important points in planting are to be sure that the roots are kept in their natural position and not crowded, bent or twisted, and that the earth is packed firmly about them. Air spaces around the roots mean the death of the plant. Loose dirt or litter is left on the surface as a mulch.

Planting is done better by two men than one. One man makes the holes and clears brush if necessary; the other carries the plants and does the actual planting. Two men working in this way can plant about 1,000 pine seedlings in a 10-hour day. Hardwood seedlings take longer.

The best weather conditions for planting are a cloudy day just before or just after a rain.

CARE OF THE PLANTATION

The young plantation needs little care outside of protection from fire and livestock. Even a light fire can wipe out the entire plantation. If not killed, the young trees are seriously retarded in their growth and the effect is the same as if the planting had been retarded several years. Fire protection is therefore a highly important measure. Fire breaks can be plowed around the area and a watch kept in times of greatest danger.

Stock must not be allowed to run in the plantation for a few years after planting. There is danger of the trees being eaten or stepped on and crushed. When the trees are five or six feet high stock will do very little harm, except to hardwoods.

COSTS OF PLANTING

The expense of obtaining the small trees will be an important item of cost. The expense of handling and planting will depend on local wages. By spacing seedlings 6x6 feet two men can plant an acre of pine seedlings in 12 hours. The cost of the seedlings includes packing and shipping and will range from $2.00 to $3.50 per thousand for pines and higher for hardwood.

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Uses of Georgia Woods

With Directory of Wood Manufacturers, Saw Mills and Dealers in Lumber and Mill Work Materials

(*Third Edition*)

By

CHARLES A. WHITTLE

Director of Education and Utilization

PROTECTION
CONSERVATION
PERPETUATION

GEORGIA
FOREST SERVICE

Uses of Georgia Woods

The value of Georgia's wood products in 1925, as given by the United States Census, was $122,000,000. From the state's 23,000,000 acres in forests it is possible to grow trees that can be utilized to produce commodities worth annually more than $122,000,000. To do this, the landowners must manage the forests so that they will produce the maximum wood growth. This means that the landowner must protect the forest from fire, thin it properly, harvest mature trees and otherwise practice good forest management.

But to realize the full value of the state's forest resources there should be a full appreciation of the uses of its various woods.

Each year large quantities of building material are shipped into Georgia that could as well have been supplied by Georgia forests. For instance, white pine, not grown in appreciable amounts in the South, is often specified for frames, doors and sash for Georgia structures, whereas cypress, yellow pine and other southern woods could be used.

Georgia has a wealth of trees desirable for use in interior finishing which it is not using to the greatest advantage Nothing is more beautiful and suitable for interior finishing than red gum, black walnut and magnolia. Cypress, chestnut, oaks and other trees grown in this state also lend themselves to this purpose. Yet quite a good deal of money is spent annually for this class of material produced in other sections of the country.

In the hope of aiding the forest owner to a better understanding of his forest resources and his market, and in the hope of stimulating larger demands for Georgia's woods, this publication presents brief statements of the character and uses of *leading commercial woods* of the state, and also a list of leading saw mills, woodworking plants and lumber dealers of Georgia.

Fire Protection Essential

Too much stress cannot be laid on forest fire prevention as an essential to growing trees with reasonable rapidity and for producing sound lumber. When fire passes through a Georgia forest as a rule the flames consume only the leaves and debris on the forest floor and scar the butts of the large trees. But sometimes when there is considerable debris, such as is usually left after a logging operation, the flames are so intense as to kill a part or all the trees.

Even when the fire is of the ordinary kind that does not kill the larger growth, the harm resulting is that (1) seedlings are killed; (2) the humus that is an important source of tree plant food is destroyed, thus starving the trees and slowing down their rate of growth; (3) the mulch covering the forest floor that absorbs and conserves the rainfall needed for tree growth is consumed.

Fires burn the trunks of trees destroying some of the tissue needed in carrying plant food up from the soil. Decay enters these scars and penetrates to the heart of the trunk, causing hollow places and destroying the best lumber in the tree.

The weakening of trees resulting from decreased supply of plant food and moisture and the decay that the fires are responsible for, cause trees to be more susceptible to insect and disease injury. This means destruction of wood or impairment of the quality of the lumber.

The Georgia Forest Service is undertaking through various means to educate the public to an appreciation of the meaning of forest fires. It has its timber protective organizations through which federal aid is extended; it is cooperating with 100 rural high schools in conducting demonstration forests that teach methods of fire control; it cooperates in putting on moving pictures that teach forest fire prevention to rural schools throughout the state; it has prepared and distributed forest fire posters; carries on campaigns through newspapers and with every opportunity representatives of

the Georgia Forest Service talk to audiences and speak to individuals about keeping fires out of the forests. It is a campaign that everyone is invited to join and urged to wage in Georgia.

Leading Woods of Georgia and Their Uses

Descriptions of leading woods of Georgia and statements of their main uses are given below. Other uses than those mentioned may exist and still others may be developed.

Pines

Loblolly (*Pinus taeda.*) Found most abundantly in upper coastal plain and lower Piedmont. In the market it is included in the class of "yellow pine." The grain is coarser than longleaf pine and the wood is lighter and softer. It is used for building materials, box shooks, barrel staves, basket veneer, pulpwood, lath, mine props, piling, crossties, telephone poles when creosoted; for excelsior and sometimes for turpentining though the yield is poor.

Longleaf Pine (*Pinus palustris.*) It is prevalent in the coastal plain and scattered in comparatively small quantities in the Piedmont area. The wood is heavy, hard, strong, nearly all heart, and is quite durable. It is used for all kinds of building material and because of its strength it is used for long timbers in construction of buildings, bridges, columns, masts, spars, etc. It is also used as crossties, posts, mine prop, log cabins, staves, shingles and palings. Creosoted blocks of longleaf pine are used for paving. The dead leaves (pine straw) are employed for making baskets and fancy holders of various kinds. Its gum is used for naval stores—that is, turpentine, rosin, tar, etc. This is obtained not only by chipping off the bark and collecting gum, but by distilling stumps, roots and tree tops left after logging. A fibre residue

of the distillation process is used for packing purposes and for making wall board. The pine needles or leaves are used for making baskets and mats and for charcoal production.

Slash Pine (*Pinus caribaea.*) Slash pine is found in the coastal plain and predominates over the longleaf on low, moist lands. It grows more rapidly than longleaf for the first thirty years. The wood is heavy, hard, strong, tough and durable. It is highly resinous and is a heavy yielder of naval stores products. Its wood and leaves are adapted very generally to the same purpose ascribed to longleaf pine.

Shortleaf Pine (*Pinus echinata.*) This variety predominates in the mountainous section and is found quite generally in the Piedmont area. The wood is moderately hard and strong, its color yellowish to dark brown. It is manufactured into lumber, boxes, crates and other containers. It is in demand for woodpulp, veneers, excelsior, cooperage and mine props.

Black Pine (*Pinus serotina.*) This is sometimes called pond pine and pocosin. It grows in low, swampy, sour lands of the coastal plain. While inferior to longleaf in quality of lumber it is generally accepted as "yellow pine" by the trade. The wood is heavy, coarse-grained, orange to pale yellow in color with abundant sapwood. It can be used as other pines described for most types of construction.

Other Conifers. A limited amount of white pine, hemlock, scrub and pitch pine is found in the mountainous part of the state. White pine is in ready demand for building purposes. The other pines will probably find their greatest use in the production of wood pulp.

Oaks

White Oak (*Quercus alba.*) The white oak is common to all parts of the state. Its wood is durable, tough, strong, elastic and straight grained, qualities that recommend it for many uses, such as beams, furniture, book cases, vehicles, tight cooperage, interior finish, baskets, splint bottomed

chairs, crossties, fence posts, etc. Its acorns make good hog feed. The inner bark of young trees is distilled for medicinal purposes.

Post Oak (*Quercus stellata.*) This tree is widely distributed over the state. Its wood is light to dark brown, hard, close-grained, durable in contact with the soil. It is used for many of the purposes to which white oak is put, such as furniture, interior finish, beams, crossties, fence posts and flooring, but the lumber is not considered quite as good as white oak. It makes fairly good staves.

Southern Red Oak (*Quercus rubra.*) This is also called Spanish oak, and grows widely over the state. The wood is hard, strong, coarse-grained, not durable. The wood is light red. It is used for rough furniture, general construction, crossties, interior finishing and cooperage. Its bark is used for making tannin.

Northern Red Oak (*Quercus borealis*) is scattered through the state, but is most common in the mountains. It is used for cooperage, interior finish, general construction, furniture, crossties, etc.

Black Oak (*Quercus velutina.*) This tree is also called yellow oak and grows extensively over the state. Its wood is bright reddish-brown with a thin layer of paler sapwood. It is sold as "red oak" and used for the same general purposes. The bark is used to produce a yellow dye and is also used for making tannic acid.

Water Oak (*Quercus nigra.*) Water oak grows along streams, in bottom lands and along borders of swamps. The wood is light-brown, heavy, hard and strong. It is used for crossties, pilings and fuel, and is favored for planting as a shade tree.

Other oaks belonging to the water oak class and similarly used are the laurel oak (*quercus laurifolia*) and willow oak (*quercus phellos*).

Chestnut Oak (*Quercus montana.*) This tree is widely distributed in the mountainous section of the state, especially on rocky, gravelly slopes. Its wood is heavy, hard, strong and durable in contact with soil, ranking close to white oak. It is used for crossties, bridge timbers, fence posts and rough construction. Its bark is preferred to all other oaks for its tannic acid.

Swamp Chestnut Oak (*Quercus prinus.*) Sometimes called "basket oak" because it is adapted to making baskets, and sometimes called "cow oak" because its leaves are eaten by cows. It is sparsely distributed. It makes excellent wood, with uses similar to white oak; in fact, is sold as white oak.

Live Oak (*Quercus virginiana.*) This variety is abundant in the coastal plain. The wood is heavy, tough, hard, nearly white. It was formerly used extensively as "ship knees." It is used for mauls, rollers, meat blocks, wood pulp and veneer. The sweet kernel of its nut makes it palatable. Indians boiled and parched it and ate it as bread.

Other Oaks. Turkey oak (*Quercus catesbaei*) is a common oak of the coastal plain dry ridges and hammocks. It is used to some extent as rough lumber and general construction. Scarlet oak (*Quercus coccinea*), sometimes called pin oak ,widely distributed but sparse, is sold as red oak and is also planted as shade trees. Black Jack oak (*Quercus marilandica*) is found in all parts of the state. Its only use at present is for fuel.

Tulip (Poplar)

Yellow Poplar (*Liriodendron tulipifera.*) This valuable tree grows in all parts of the state, reaching its greatest growth in rich cove lands of the mountains. Its wood is light yellow or brown; light, soft and easily worked; put to a great variety of uses, such as building materials, exterior and interior, veneers, vehicle bodies, turnery, woodenware,

furniture, imitation mahogany veneer, excelsior, boxes, crates, porch columns, shingles, baskets, woodpulp, crossties, etc.

Cypress

Cypress (*Taxodium distichum*) is found in the lower coastal plain in deep swamps and in low, moist lands along streams. The wood is light and soft but very durable. Its color varies from light sapwood to dark brown heartwood. The wide adaptability of this wood makes it economically very important. Its durability under exposure and contact with soil makes it very desirable for sash, doors, frames, blinds; for piles, crossties, tanks, telegraph poles, shingles, water pipes, silos, buckets, churns, freezers, boats, greenhouse frames, etc.

Gums

Red Gum (*Liquidambar styraciflua.*) This tree is also known as "sweet gum." It is widely distributed over the state and in recent years has become one of the valued woods. The heartwood is reddish brown and the sapwood of lighter color. The wood is close-grained, moderately hard, heavy. It lends itself to interior uses in the place of Circassian walnut, which with proper treatment, it very closely resembles and, by many, considered more beautiful. It also can be stained to resemble mahogany. It should be more generally used for furniture, desks, cabinets, doors, interior finishings of homes and store buildings; for gun stocks, boxes, floors, woodpulp, etc.

Black Gum (*Nyssa biflora*) is a different species of tree from red gum. It is also called sour gum and bee gum, and is found in great abundance in low, wet lands and swamps over the state. The wood is tough, cross-grained. It is used for crate and basket veneers, box shooks, rough floors, rollers, mallets, mauls, hubs, woodpulp, etc. A variety

of black gum (*nyssa sylvatica*) is common on dryer lands and is very similar in appearances and uses to black gum above described. In fact, it is not generally regarded as being different from it.

TUPELO (*Nyssa aquatica, Nyssa uniflora Wang*), sometimes sold as bay poplar, is native to swamps. Formerly considered worthless as lumber, but with improved method of curing it has become useful in all lines in which yellow poplar is used. On account of its freedom from splintering it is desirable for flooring of warehouses and freight platforms. Its chief uses are for veneer for boxes, crates, etc. Cigar boxes and musical instruments are made of it.

CHESTNUT

CHESTNUT (*Castanea dentata*) is native to the mountain and Piedmont region. On account of the spread of chestnut blight against which no defense has been found, this tree is threatened with extinction. It is, therefore, important to utilize it to the fullest extent before it is killed. The wood is soft, light, straight-grained and very durable in contact with the soil. It can be used for a large number of purposes, such as interior finish, sash, doors, frames, sheeting, crossties, telephone poles, posts and shingles. Both wood and bark are in demand by tanneries.

CEDAR

RED CEDAR (*Juniperus virginiana*) is found in all parts of the state The heart wood is quite red and the sapwood white, this contrast adding to its attractiveness. The wood is strong, soft, with straight grain. Its adaptability to lead pencils is unsurpassed. On account of its durability, cedar has been favored for telephone and telegraph poles and fence posts. Sawed into lumber it finds popularity in the production of clothes chests, for lining of closets, for interior finishings of rooms, etc. A valuable oil is made from the wood and green twigs.

White Cedar (*Chamacyparis thyoides*) is common to South Georgia swamp lands or "glades." The wood is soft, close-grained, slightly aromatic. It is in demand for cooperage, shingles, fence posts, boats, telephone and telegraph poles, etc.

Walnut

Black Walnut (*Juglans nigra*) is found growing on rich lowlands and fertile hillsides in various parts of the state. Its wood is hard, strong, heavy, close-grained and susceptible of high polish. The color of the wood of old trees is a rich chocolate brown. The wood is highly valued for furniture, desks, cabinets, interior finishing, gun stocks, sewing machines, musical instruments and airplane propellors. Black walnut lumber brings the highest price of any Georgia grown wood. The nuts are a source of revenue and the hulls of the nuts were formerly used for making a dye for homespun cloth.

White Walnut (*Juglans cinera*), sometimes called butternut. It is found only in the mountains where it is quite common. The wood is light brown, light, soft, coarse-grained, not strong. It takes a high polish and is used for interior finishing and furniture. A yellow or orange dye is made from the hulls of the nut.

Hickory

White Hickory (*Carya alba*)—also known as white-heart hickory and mockernut hickory, has a wood very hard, heavy, strong, tough and pliable. The heartwood is light brown to reddish with rather wide margin of white sapwood, not durable in contact with the soil. It is common to all well-drained soils throughout the State. Its wood is used for vehicles, tool handles, athletic goods, for smoking meats, etc.

Scaly-Bark Hickory (*Carya ovata*) is found along streams and rich moist hillsides throughout the state. The wood is heavy, strong, hard, tough and flexible and is used

for tool handles, vehicles and many other ways where strength and flexibility of woods are desired.

The wood of all hickories is used for very much the same purposes. Other hickories found widely over the state are: Pignut Hickory (Carya Glabra), found mainly in middle Georgia, and Bitternut Hickory (Carya Minima), scattered over the state, having reddish-brown wood somewhat inferior to other hickories. Less important commercially are Swamp Hickory (Carya Aquatica) and Pecan (Carya Pecan).

Ash

White Ash (*Fraxinus americana*) is common to all parts of the state. The wood is white to brown in color and is highly prized because of its toughness and elasticity, and for this reason is used for handles for athletic goods such as rackets, bats, oars, and for vehicles, furniture, interior finish, etc.

Water Ash (*Fraxinus caroliniana*) and Green Ash (*Fraxinus pennsylvanianca lanceolata*) appear over the state, but are not equal to white ash and are not abundant enough to be of much commercial importance.

Cherry

Wild Cherry (*Prunus serotina*), also called Black Cherry, reaches greatest development in the mountainous portion of the state. The wood is reddish-brown, close-grained and hard and takes a beautiful finish. It is highly prized for interior finish, cabinet making, veneer, panels, etc. Next to walnut, it brings the highest market price of any wood in eastern United States. Its bark is used for medicinal purposes, especially in cough medicines.

Beech

Beech (*Fagus grandifolia*) grows throughout the state usually in association with hickories and oaks on rich moist

land, its greatest development being in mountain coves. The wood is hard, light red in color, strong, tough, but is not durable when exposed to weather or soil. It is used for flooring, tools, novelty wares, charcoal, crates, veneer, bobbins, clothes pins, shoe lasts, boxes, handles, etc.

Blue Beech (*Carpinus caroliniana*), also called water beech, is found along streams throughout the state and is not abundant enough to be of much economic value. Its wood is used for tool handles, wooden cogs, mauls, wedges and levers.

Hornbeam (*Ostrya virginiana*), also called Ironwood, is used in the same manner as beech.

Locust

Black Locust (*Robinia pseudacacia*), also known as yellow locust, found throughout the northern half of the state. The wood is yellow, coarse-grained and durable in contact with soil. It is prized as crossties, fence posts, telephone poles and insulator pins.

Honey Locust (*Gleditsia triacanthos*), well known for its long pods, is scattered throughout the state. The wood is reddish-brown, not as durable as black locust, but is used successfully for fence posts, crossties and hubs. The pods provide food for hogs.

Magnolia

Magnolia (*Magnolia grandiflora*), a well-known evergreen, grows to large size in moist soils of coastal plains. Its cream colored wood is moderately heavy and hard. It is coming into popularity for interior finishing, veneer, basket and crate manufacture and kitchen furniture. It is an outstanding evergreen tree of the South for ornamental planting and is grown for such purposes far north of its natural habitat.

Mountain Magnolia (*Magnolia fraseri*) grows in the mountainous portion of the state, but is not commercially important. It is used for lumber and pulpwood.

Cucumber Tree (*Magnolia acuminata*) is also a mountain member of the magnolia family. It is used for the same purposes as poplar, its cousin.

Basswood-Linden

Basswood and Linden (*Tilia*) are close kin, and the trade uses the names interchangeably. Trees of this kind are common to the mountains. Their wood is light brown, tough, cross-grained and used for woodenware, boxes, crates, millwork, picture frames, moldings, piano keys, bread-boards, ironing boards, excelsior and woodpulp. Formerly their tough barks were used for making ropes.

Birch

River Birch (*Betula nigra*), also called Red Birch, is found along streams, ponds, in swamps and semi-swamp lands. The wood is close-grained and strong. It is used for woodenware, turnery, wagon hubs, hoops and handles.

Black Birch (*Betula lenta*) is also known as Sweet Birch and Cherry Birch. It occurs only in hills and mountains. The wood is heavy, strong, hard and compact. Its dark-brown color has given it a local name of "mountain mahogany." It is used as a substitute for mahogany in making furniture, interior finishing, flooring, etc.

Hemlock

Hemlock (*Tsuga canadensis*) is found in the mountains of Georgia. The wood is light, soft, brittle and splinters readily. It is used for coarse lumber and woodpulp. The bark is valued for its tannin.

Carolina Hemlock (*Tsuga caroliniana*) is also found in the mountains, and its wood and bark are used as described for Tsuga canadensis.

Sycamore

Sycamore (*Platanus occidentalis*), also called Buttonwood, grows throughout the state along streams and bottom lands. The wood is hard and moderately strong. Its chief uses are for butchers' blocks, tobacco boxes, interior finish, furniture and veneer.

Sassafras

Sassafras (*Sassafras officinale*) grows in all parts of the state on dry soils, but not in the higher mountains. Its wood is soft and brittle, but is durable in contact with the soil. It is used for posts, rails, cooperage, etc. The bark and roots are used to produce sassafras tea; also oil of sassafras employed by flavoring.

Willow

Black Willow (*Salix nigra*) is common along streams, ponds, and in moist lands throughout Georgia. Its wood is soft, light, but not strong. It is employed in making artificial limbs, high-grade charcoal, excelsior, boxes and crates. The twigs are plaited to protect river banks from erosion. Its bark contains salicylic acid which is used for medicinal purposes.

Cottonwood (*Populus deltoides*), sometimes referred to as Carolina poplar, is scattered widely over the state, nowhere abundant. The wood is soft, light-weight, warps, but finds several uses such as substitutes for yellow poplar and linden, and converted into wood pulp makes high-grade paper.

Swamp Cottonwood (*Populus heterophylla*), Silverbell, is common along borders of rivers and swamps in the coastal plain region. The wood is light and soft. It is used for veneer, wood pulp and excelsior.

Maple

Red Maple (*Acer rubrum*) is known also as Swamp Maple, and is widely distributed through the state. Its wood

is sold as "soft maple" and is used in the manufacture of furniture, flooring, woodenware, turnery and paper pulp.

Silver Maple (*Acer saccharinum*) is found on moist lands and along streams. The wood is soft, smooth and rather brittle and is used for the same purposes as red maple.

Persimmon-Dogwood-Holly

Persimmon (*Diospyros virginiana*) is found throughout the state. The wood is hard, dense, strong. The color of the heartwood is brown to black, the wide sapwood, white or yellowish. The wood is used for the manufacture of shuttles, bobbins, etc., in connection with knitting mills. The fruit is high in sugar content and valuable as food for man, game, hogs and cattle.

Dogwood (*Cornus florida*) is in great demand by cotton mills for the same purposes as persimmon. It is used for turnery, handles, forms, novelties, etc.

Holly (*Ilex opaca*), while regarded as having its greatest value as a source of holiday greens, it is sometimes cut and used for cabinet work, wood-turning, etc.

Directories

Wood Manufacturers, Saw Mill Operators and Lumber Dealers of Georgia

(In making up the following directories all available sources of information have been consulted, such as associations membership and other trade directories. It is possible that in spite of all our efforts some names may have been omitted. Any information that will help make the directories more complete will be welcomed for use in future issues of this bulletin.)

CHIEF ARTICLES MANUFACTURED FROM WOOD IN GEORGIA AND NAMES OF LEADING PRODUCERS

AGRICULTURAL IMPLEMENTS:

Athens Foundry & Machine Works, Athens
Atlanta Plow Co., Atlanta
Benton Manufacturing Co., Monticello
Camp, E. N & Son, Moreland
Gantt Manufacturing Co., Macon
Lilliston Implement Co., Albany
Southern Plow Co., Columbus
Tom Huston Mfg. Co., Columbus
Towers & Sullivan, Rome

AUTO BODIES:

Columbus Fender & Body Works, Columbus
Savannah River Lbr. Co., Savannah
Yancey Brothers, Atlanta

BASKETS:

Atlanta Woodenware Co., Atlanta
Georgia Basket & Lbr. Co., Brunswick
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Menlo Fruit Package Co., Menlo
Peerless Basket Co., Cuthbert
Pierpont Mfg. Co., Savannah

BEE HIVES:

Wilder, J. J., Waycross

BLOCKS:

Southern Wood Preserving Co., Atlanta

BOBBINS AND SHUTTLES:

Jordan Mfg. Co., Monticello
Norris Bros., Macon

BOXES:

Acworth Building Supply Co., Acworth
Champion Box Co., Thomasville
Cohutta Lumber Co., Chatsworth
Cunningham-Wayne Box & Crate Co., Savannah
Davis-Corum Box & Lumber Co., Macon
Dawson Variety Works, Dawson
Dudley Sash, Door & Lbr. Co., Columbus
Elberta Crate Co., Bainbridge
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Glover Casket Co., Rome
Griffin Box Co., Griffin
Hightower Box & Tank Co., Atlanta
Jeffreys & McElrath Mfg. Co., Macon
Maxwell Brothers, Macon
Menlo Fruit Package Co., Menlo
Moultrie Box & Crate Co., Moultrie
Mutual Mfg. Co., Savannah
O'Neill Lumber & Box Mfg. Co., Rome
Pierpont Mfg. Co., Savannah
Reynolds Brothers Lbr. Co., Albany
Southern Novelty Works, Demorest
Union Box Mfg. Co., Atlanta

CAR BUILDERS:

Georgia Car & Locomotive Co., Atlanta

CARRIAGES:

Griffin Buggy Co., Griffin
Jones, J .W, Cartersville
Norman Buggy Co., Griffin
Smith, Jackson G. & Co., Barnesville

CASKETS:

Atlanta Casket Co., Atlanta
Capitol City Casket Co., Atlanta

CASKETS—Continued
Glover Casket Co., Rome
Columbus Casket Co., Columbus
Juniper Casket Co., Juniper
Junction City Mfg. Co., Junction City
Maddox, B. R., Jesup
Mutual Mfg. Co., Savannah
McNatt Coffin & Casket Co., Vidalia
National Casket Co., Atlanta
Southland Casket Co., Atlanta
Warm Springs Planing Mills, Warm Springs

CHARCOAL:
Atlantic Turpentine & Pine Tar Co., Savannah
Valdosta Tar & Turpentine Co., Valdosta

COOPERAGE
Armuchee Cooperage Co., Rome
Cannon, The Co., Cairo
Colquitt County Cooperage Co., Moultrie
Etowah Cooperage Co., Rome
Georgia Cooperage Co., Tallapoosa
Georgia Stave Co., Valdosta
Macon Cooperage Co., Macon
McElvey, O. A. & J. O., Pelham
Oak City Cooperage Co., Bainbridge
Reinschmidt Stave Co., Quitman
Southern Cotton Oil Co., Savannah
Southern Heading & Mfg. Co., Valdosta
Standard Stave Co., Cairo
Woolvin, R B., Stave Co., Dublin

COTTON GIN MACHINERY:
Cen-Tennial Cotton Gin Co., Columbus
Continental Cotton Gin Co., Columbus
Lummus Cotton Gin Co., Columbus
Massey Gin & Machine Works, Macon
Murray Company, Atlanta
Sea Island Cotton Gin Co., Vidalia

CRATES:
Champion Box Co., Thomasville
Cunningham-Wayne Box & Crate Co., Savannah
Elberta Crate Co., Bainbridge
Enterprise Mfg. Co., Waycross
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Fort Valley Crate & Lbr. Co., Fort Valley
Moultrie Box & Crate Co., Moultrie
Pierpont Mfg. Co., Savannah
Southern Crate & Veneer Co., Macon
Wilder Lumber Co., Tifton
Wadley Veneer & Basket Co., Wadley
Union Box Mfg. Co., Atlanta

CROSS TIES (R. R. Material):
Atlantic Tie & Timber Co., Savannah
Baxley Planing Mill, Baxley
Bladen Tie & Lumber Co., Brunswick
Chauncy, V. N., Jesup
Dicky, Lon, Fitzgerald
Houston Lbr. Co., Thomasville
Joyce-Watkins Co., Brunswick
Mutual Timber Co., Brunswick
Seals, C. N., Kingsland
Southern Tie & Timber Co., Atlanta
Stubbs & Stubbs, Douglas
Superior Pine Products Co., Fargo
Southern Wood Preserving Co., Atlanta
Werden-Empire Lbr. Co., Albany

DIMENSION STOCK:
Cleveland-Oconee Lbr. Co., Atlanta
Batson-Cook Co., West Point
Case-Fowler Lbr. Co., Macon
Green Bros., Waynesboro
Harrison, T. I., Sandersville
Massee & Felton Lbr. Co., Macon
Middle Ga. Lbr. Co., Wadley
Moore Lumber Co., DeSoto
Stovall, W. I., Sautee
Savannah River Lbr. Co., Savannah
West, W. J., Lbr. Co., Rising Fawn

EXCELSIOR:
Augusta Bedding Co., Augusta
DuPre Mfg. Co., Atlanta
Georgia Cushion & Wrapper Co., Woodland
Wadley Veneer & Basket Co., Wadley

FIXTURES:
Commercial Mfg. Co., Atlanta
Cooper Lbr. Co., Columbus
Krueger Mfg. Co., Atlanta
Macon Cabinet Works, Macon
Muecke & Sons Co., Macon
National Show Case Co., Columbus
Womack, J. P., & Sons, Atlanta

FLOORING:
Atlanta Oak Flooring Co., Atlanta
Karwisch, J. M., Wagon Works, Atlanta
Kriegshaber, V. H., & Son, Atlanta
Southern Wood Preserving Co., Atlanta

FURNITURE:
Arrimo Mfg. Co., Augusta
Austell Cabinet Co., Austell
Atlanta Table Co., Atlanta
Atlas Furniture Mfg. Co., Atlanta
Art Furniture Mfg. Co., Macon
Blanchard, Carter & Shebane, Crawford
Bellwood Novelty Works, Atlanta
Brumby Chair Co., Marietta
Bond & Waite Mfg. Co., Toccoa
Capitol City Chair Co., Atlanta
Chattahoochee Furniture Co., Flowery Branch
Coastal Cabinet Works, Brunswick
Carmichael Furniture Co., Atlanta
Carter Show Case Co., Atlanta
Cleveland-Oconee Lbr. Co., Atlanta
Currahee Furniture Co., Toccoa
Diana Furniture Co., Toccoa
Duane Chair Co., Dalton
Estes Wollcott Co., Rex
Floyd Brothers, Atlanta
Fox Mfg. Co., Atlanta
Geiger, W, T. P., Vidalia
Georgia Chair Co., Gainesville
Ginn Mfg. Co., Carnesville
Gholstin Spring & Mattress Co., Atlanta
Ideal Furniture Co., Athens

FURNITURE—Continued

Knott & Carmichael, Atlanta
Krueger Mfg. Co., Atlanta
Macon Cabinet Works, Macon
Macon Lbr. & Mfg. Co., Macon
Morrow-Cook Furniture Co., Albany
Muecke & Sons Co., Macon
Rome Cabinet Co., Rome
Rome Chair Co., Rome
Rome Furniture Co., Rome
Smith, Jackson G. & Co., Barnesville
Southern Desk & Table Co., Atlanta
Southern Novelty Works, Demorest
Spratt Chair Co., Atlanta
Stambaugh, C. W., Demorest
Star Furniture Co., Athens
Toccoa Furniture Co., Toccoa
Trogdon Furniture Co., Toccoa
Union City Cabinet Works, Union City
Washington Mfg. Co., Washington
Winder Furniture Co., Winder
Womack, J. P. & Sons, Atlanta

HANDLES:

Atlanta Woodenware Co., Atlanta
Fowler Wainwright Hardware Co., Macon
Hanna Mfg. Co., Athens
Savannah Handle Co., Savannah
Standard Tool & Handle Co., Macon
Tifton Handle Mfg. Co., Tifton

LATH:

Barfield Lbr. Co., Vienna
Carolina Portland Cement Co., Atlanta
Daugherty McKey & Co., Valdosta
East Point Lbr. Co., East Point
Farrar Lbr. Co., Bainbridge
Kreigshaber, V. H. & Son, Atlanta
Pineora Mfg. Co., Pineora
Reynolds Bros. Lbr. Co., Albany
Williams, Homer, Thomasville
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
Zuber, John W., Atlanta

LOG CARTS:

Williams Mfg. Co., Macon

PLYWOOD:

Clark, R. C., Veneer Co., Atlanta
Southern Hardwood Lbr. Co., Waynesboro

PILES, POLES, POSTS:

Bacon, A. S. & Sons, Savannah
Chauncy, V. N., Jesup
Georgia Creosoting Co., Brunswick
Savannah Creosoting Co., Savannah
Seals, C. N., Kingsland
Southern Wood Preserving Co., Atlanta
Superior Pine Products Co., Fargo

REFRIGERATORS:

Warren, The Co., Atlanta
Wright, The Co., Atlanta

SADDLE TREES:

Flor, Edward Co., Demorest

SASH, DOORS, BLINDS, MILLWORK:

American Box & Lbr. Co., Macon
Americus Construction Co., Americus
Augusta Lbr. Co., Augusta
Bacon, A. S. & Sons, Savannah
Baxley Planing Mill, Baxley
Branch, Mrs. F. T., Quitman
Bright-Brooks Lbr. Co., Savannah
Bond & Waite Mfg. Co., Toccoa
Butler, John G., Savannah
Carter Lbr. & Mfg. Co., Columbus
Central Sash & Door Co., Macon
Cole, R. D. Mfg. Co., Newnan
Cooper Lbr. Co., Columbus
Cordele Sash, Door & Lbr. Co., Cordele
Crisp County Lbr. Co., Cordele
Carter Brothers, Rochelle
Case-Fowler Lbr. Co., Macon
Dawson Variety Works, Dawson
DeKalb Supply Co., Decatur
Campbell's Variety Works, Rockmart
Disbro Lbr. Co., Atlanta
Douglas Novelty Co., Douglas
Dublin Sash & Door Co., Dublin
Dudley Sash, Door & Lbr. Co., Columbus
East Point Lbr. Co., East Point
Farrar Lbr. Co., Dalton
Gresham Mfg. Co., Griffin
Harvey, W. T. Lbr. Co., Columbus
Jakin Novelty Works, Jakin
Lang's Variety Works, Sandersville
Lanier, J. W., Valdosta
LaGrange Lbr. & Supply Co., LaGrange
Marbut-Williams Lbr. Co., Atlanta
Marshall Mfg. Co., Rome
Meigs Variety Works, Meigs
Moss, R. L. Mfg. Co., Athens
New, D. F., Carrollton
O'Neill Box & Lbr. Co., Rome
Pattillo Lbr. Co., Atlanta
Perkins Mfg. Co., Atlanta
Phoenix Planing Mill Co., Atlanta
Randall Bros., Atlanta
Shore, F. M. & Co., Quitman
Thomasville Variety Works, Thomasville
Valdosta Builders Supply, Valdosta
Washington Mfg. Co., Washington
Willingham Sash & Door Co., Macon
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
W. S. Askew Co., Newnan
Williams, Homer, Thomasville

SHINGLES:

Archer, J. M., Sparta
Bacon, A. S. & Sons, Savannah
Baker & Co., Valdosta
Barfield Lbr. Co., Vienna
Chauncy, V. N., Jesup
Dougherty, McKey & Co., Valdosta
Downer Lbr. Co., Valdosta
Daniel, J. W., Franklin
East Point Lbr. Co., East Point
Farrar Lbr. Co., Bainbridge
Franklin, H. M. & Co., Tennille
Harrell, N. E., Pearson
McIntyre, Arch, Ousley
Mason Lbr. Co., Ochlochnee
Owens, A. J., Canon
Pierce, W. E., Edison
Pineora Mfg. Co., Pineora
Shiner, J. B., Poulan
Sumner, E. J., Wrightsville
Superior Pine Products, Fargo
Warnock, D. F., Tarrytown

SHINGLES—Continued
Wilder Lbr. Co., Tifton
Williams, Homer, Thomasville
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
Zuber, Jno. W., Atlanta

SHOOKS:

Elberta Box Co., Bainbridge
Hightower Box & Tank Co., Atlanta
Jeffreys & McElrath Mfg. Co., Macon
O'Neill Lbr. & Box Mfg. Co., Rome
Pierpont Mfg. Co., Savannah
Union Box Mfg. Co., Atlanta

TANKS:

Hightower Box & Tank Co., Atlanta
Quitman Cooperage Co., Quitman

TRUCKS, TRUCK BODIES:

Columbus Truck & Supply Mfg. Co., Columbus
Fairbanks Co., Rome
Georgia Car & Locomotive Co., Atlanta
Miller, A. C. & Co., Atlanta
Williams Mfg. Co., Macon
Yancey Brothers, Atlanta

VENEER:

Augusta Veneer Co., Augusta
Brown, Robt. A., Raymond
Clark Veneer Co., R. C., Atlanta
Crown Mountain Veneer Co., Dahlonega
Dublin Veneer & Package Co., Brunswick
Georgia Veneer & Package Co., Brunswick
Glyck Veneer & Lbr. Co., Macon
Houston Mfg. Co., Perry
Lovelace-Brown Lbr. Co., Thomson
Midville Veneer Co., Midville
Reynolds Bros. Lbr. Co., Albany
Pierpont Mfg. Co., Savannah
Southern Crate & Veneer Co., Macon
Wadley Veneer & Basket Co., Wadley
Peerless Basket Co., Cuthbert

WAGONS:

Hancock Wagon Co., Culverton
Karwisch, J. M., Wagon Works, Atlanta
Sanders, John D., Waynesboro
Tarwood Mfg. & Supply Co., Dublin
White Hickory Wagon Mfg. Co., East Point
Williams Mfg. Co., Macon

WOODENWARE:

Atlanta Woodenware Co., Atlanta

SAW MILL OPERATORS OF GEORGIA

ACWORTH, Cobb County
Mills Lbr. Co. of Ga., Inc.

ADEL, Cook County
Adel Mfg. Co.

AILEY, Montgomery County
Thompson, H. V. & Bros.

ALAMO, Wheeler County
Adams, J. W.
Clark, W. M. & Co.

ALBANY, Dougherty County
Allen Brothers Lbr. Co.
General Lbr. Co.
Home Builders Lbr. & Supply Co.
Clancy Lbr. Co.
Reynolds Bros. Lbr. Co.

ALSTON, Montgomery County
Daniel, J. Fred & Sons
McArthur, J. J.
Sharpe, J. S.

AMERICUS, Sumter County
Lovelace, T. B., Lbr. Co.

AMSTERDAM, Decatur County
Gragg Lbr. Co.

ARGYLE, Clinch County
Garrant Lbr. Co.

ASHBURN, Turner County
Carter, C. W.
Thrasher, C. E.

ATHENS, Clarke County
Athens Saw & Planing Mill

ATLANTA, Fulton County
Cleveland-Oconee Lbr. Co.

AUGUSTA, Richmond County
Augusta Hardwood Co.
Georgia Hardwood Lbr. Co.
Richmond Lbr. Co.
Woodward Lbr. Co.

BAINBRIDGE, Decatur County
Battle & Hodges
Carr, A. S. Co.

BANNING, Carroll County
Hanson, J. R.

BARNESVILLE, Lamar County
Barnesville Planing Mill Co.
Lavender & Brown
Milner Lbr. Co.

BARTOW, Jefferson County
Brown, T. S.
Hall, J. M.
Salter & Evans

BAXLEY, Appling County
Baxley Planing Mill
Miles, D. P.
Sellers, E. W.
Williams, N. F.

BLACKSHEAR, Pierce County
Johnson, A. M.
Woodall, C. C. Lbr. Co.

BLAKELY, Early County
Bailey, J. F. & Son
Hall, W. A. Lbr. Co.
Hunt, Washington & Hunt
Stuckey, Chas.

BLUFFTON, Clay County
Rambo, M.

BOSTON, Thomas County
Sherrod, J. H. & Sons

BROOKLET, Bulloch County
Altman, W. R. Lumber Co.
Howard, J. R.
Shearwood Lbr. Co.

BROOKLYN, Stewart County
Bell-Tate Lbr. Co.

BROOKS, Fayette County
Cooper Bros.
Lunsford, J. A.

BROXTON, Coffee County
Sapp, J. L.

BRUNSWICK, Glynn County
Brunswick Timber Co.
Haddock, Tomlinson Co.
Harrington, W. D.

BUCHANAN, Haralson County
Davis, W. E. & Son

BUENA VISTA, Marion County
Alexander & Burgin Lbr. Co.

BUTLER, Taylor County
Payne, W. A.

BYRON, Peach County
Cline, G. P.

CAIRO, Grady County
McCollom, P. J.
Thomas-Robinson Lbr. Co.

CALHOUN, Gordon County
Barton, H. C.
Calhoun Lbr. Co.
David, A. B.
Strain, J. A.

CAMILLA, Mitchell County
Goulden, B. H.
Manry, B. F.

CANON, Franklin County
Owens, A. J.

CARNESVILLE, Franklin County
Ginn Mfg. Co.

CARTERSVILLE, Bartow County
Shaw, L. F. & Sons Co.
Smith Lbr. Co.

CATAULA, Harris County
Alexander Bros. Lbr. Co.

CHARLES, Stewart County
Alexander & Bland Lbr. Co.

CHATSWORTH, Murray County
Cohutta Lumber Co.
Empire Talc & Lbr. Co.

CHIPLEY, Harris County
Chambers, J. M.
Champion, F. L.
Floyd, L. E.
Williams, John W.

CLARKESVILLE, Habersham County
Church, Geo.

CLAYTON, Rabun County
Bleckley, James E.
Mitchell, L. T.
Mozely, John

COLUMBUS, Muscogee County
H. Dixon Smith, Inc.

COGDELL, Clinch County
Timber Products Co.

COLQUITT, Miller County
Wilkins, P. E.

CONCORD, Pike County
Oxford, H. E.

CORDELE, Crisp County
Cordele Sash, Door & Lbr. Co.

COUNCIL, Clinch County
Council Lbr. Co.

COVINGTON, Newton County
Campbell Lbr. Co.

CRAWFORDVILLE, Taliaferro County
Flynt-Golucke Lbr. Co.

CUSSETA, Chattahoochee County
Burgin Lbr. Co.

CUTHBERT, Randolph County
King Lbr. Co.
Surles, R. E.

DACULA, Gwinnett County
Pharr, G. F.

DAHLONEGA, Lumpkin County
Hightower, W. J. & Son
Jarrard, J. C. & Bro.

DALLAS, Paulding County
Cochran, John L. Lbr. Co.
Phillips, John
Willis, D. F.

DALTON, Whitfield County
Brooker Lumber Co.
Strain, E. E.

DAMASCUS, Early County
Rose-Mary Lbr. Co.

DANIELSVILLE, Madison County
Barrett, E. B.
Rogers, B. F.

DANVILLE, Twiggs County
Danville Lbr. Co.

DARIEN, McIntosh County
Altamaha Lbr. Co.

DAVISBORO, Washington County
Warthen, W. B.

DAWSON, Terrell County
Rowland, D. H. Lbr. Mills
Shields & Geise Lbr. Co.

DECATUR, DeKalb County
Hierston, W. T.
Ozmer, J. H.

DESOTO, Sumter County
Moore Lbr. Co.

DEVEREAUX, Hancock County
Grooms, M. M. Lbr. Co.

DOLES, Worth County
Champion, J. C.

DOUGLAS, Coffee County
Pat Darby Lbr. Co., Inc.

DUBLIN, Laurens County
Dublin Sash & Door Co.
Gettys, J. M. Lbr. Co.

EASTMAN, Dodge County
Dodge County Lbr. Co.

EATONTON, Putnam County
Carpenter Lbr. Co.

EDISON, Calhoun County
Pierce, W. E.
Turman Lbr. Co.

EGYPT, Effingham County
Rountree, W. P.
Standard Lbr. Co.

ELLAVILLE, Schley County
Alexander, A. C. Lbr. Co.
Drew, J. A.
Hart, H. A.
Tidd Bros.
Smith & Wall

ELLERSLIE, Harris County
Alexander Bros. Lbr. Co.

ELLIJAY, Gilmer County
Henson Bros. & Barnes
Shippen Hardwood Lbr. Co.

ETON, Murray County
Lefurgey, J. J.

FACEVILLE, Decatur County
Hancock Lbr. Co.

FAIRMOUNT, Gordon County
Fairmount Lbr. Co.
Lowe, J. I.

FARGO, Clinch County
Superior Pine Products Co.

FAYETTEVILLE, Fayette County
Blalock Lbr. Co.
Cox, W. F.
Graves, Ernest
Redwine Bros.

FOLKSTON, Charlton County
Gowen, A. G.
Johnson, J. H.

FORSYTH, Monroe County
Hardin Lbr. Co.

FORTSON, Muscogee County
Fortson Lbr. Co.
Franklin & Carey Lbr. Co.

FRANKLIN, Heard County
Daniel, J. W.
Johnson & Hammond
Norwood, J. E.
Spradling, J. W. & Sons

GAINESVILLE, Hall County
Hammond, V. L.
North Georgia Lbr. Co.

GARDNERS, Washington County
Cleveland-Oconee Lbr. Co.

GIBSON, Glascock County
Bowden-Hooks Lbr. Co.

GIRARD, Burke County
Mobley Bros.

GLENNVILLE, Tattnall County
Burns, T. F.
Phillips, L. & Bros.
Tootle, G. W.

KITE, Johnson County
Meeks, W. B.

LAFAYETTE, Walker County
Clements & Quillian
Ponder, J. R.
Rea, J. H. B.

LAGRANGE, Troup County
Askew, W. S. Co.

LAKE PARK, Lowndes County
Ivers, C. H. & Son
Watts & Co.

LAWRENCEVILLE, Gwinnett County
Jackson, C. M.
Jackson, C. P.

LEARY, Colhoun County
Tyson & Stubbs

LILLY, Dooly County
Cox, J. E.
McCormick, D. A.

LINCOLNTON, Lincoln County
Bunch & Harnesberger
Lincoln Lbr. Co.
Wilkinson, J. G.

LIZELLA, Bibb County
Carswell, M. C.
Marshall, C. E.
Marshall, W. J.
Van Valkenburg, A. B.
Whittle & Fackler

LITHONIA, DeKalb County
Johnson, J. C.'s Sons

LOCO, Lincoln County
Taylor, Clyde H.

LOGANVILLE, Walton County
Cooper, M. E.

LOUISVILLE, Jefferson County
Jones, S. E.
Kelly, T. B. Lbr. Co.

LOVEJOY STATION, Clayton County
Dickson, J. S.

LUDOWICI, Long County
Bladen Tie & Lbr. Co.
Jones, C. D.

LUMBER CITY, Telfair County
Rush, J. H.

LUMPKIN, Stewart County
Alexander & Bland Lbr. Co.
Lawson, W. R. & Bro.

GLENWOOD, Wheeler County
Browning, J. M.
Pearson Hardwood Flooring Co.
Rivers & Jones

GRAHAM, Appling County
Ham, W. B.

GRANTVILLE, Coweta County
Grantville Oil Mill

GROVETOWN, Columbia County
Dorn, R. B.

HAMILTON, Harris County
Pine Mountain Lbr. Co.

HAPEVILLE, Fulton County
Evans-Inman Lbr. Co.

HARLEM, Columbia County
Harlem Mfg. Co.

HARTWELL, Hart County
Cobb, J. A., Saw Mill Co.

HATCHER, Quitman County
Bland, D. G. Lbr. Co.

HAWKINSVILLE, Pulaski County
Grand Bay Lbr. Co.
Hawkinsville Lbr. & Mfg. Co.
Lick Creek Lbr. Co.
Warren & DuPre

HELEN, White County
Morse Bros. Lbr. Co.

HILLSBORO, Jasper County
White Lbr. Co.

HOBOKEN, Brantley County
Newton & Jones

JACKSONVILLE, Telfair County
Williams, M. & C. W.

JERSEY, Walton County
Harris, J. T.
Wiley, B. A.

JESUP, Wayne County
Chauncy, V. N.
Garbutt Lbr. Co.

JONESBORO, Clayton County
Berry Bros.

JULIA, Stewart County
Union Lbr. Co.

JUNCTION CITY, Talbot County
Callier, N. V.

JUNIPER, Marion County
Rogers, A. N.

LUXOMNI, Gwinnett County
Hannah, A. S.
Pearson, J. H.

McINTYRE, Wilkinson County
Hall, J. M. Lbr. Co.

McRAE, Telfair County
Krumrine, J. H. C.

MACON, Bibb County
Case-Fowler Lbr. Co.
Chambers Lbr. Co.
Davis-Richardson Lbr. Co.
Georgia Hardwood Co.
James & Kingman Lbr. Co.
Massee & Felton Lbr. Co.
Richardson Lbr. Co.
Wainwright-Young Lbr. Co.

MADISON, Morgan County
Atkinson, W. W.
Mallory, T. A.
Mason Lbr. Co.

MANASSAS, Tattnall County
Holland, John L.

MARSHALLVILLE, Macon County
Goodwin, S. B.

MATTHEWS, Jefferson County
Gay, W. S.
Pennington, A. F.

MAYSVILLE, Banks County
Bacon Milling Co.

METASVILLE, Wilkes County
Lovelace, T. B. Lbr. Co.

METTER, Candler County
Brannen, I. A. & J. L.

MIDVILLE, Burke County
Fry, L. B. Lbr. Co.
Higdon Lbr. Co.
Wray-Joyner Co.

MILLEDGEVILLE, Baldwin County
Bland Lbr. Co.
Central Georgia Lbr. Co.
Crooms, M. M.

MILLEN, Jenkins County
Aaron, T. W.
Millen Lbr. Co.
Turner Lbr. Co.

MILNER, Lamar County
Chappel, A. H.

MONROE, Walton County
Monroe Lbr. Co.

MONTICELLO, Jasper County
Walker, J. N.

MORVEN, Brooks County
Elliott Lumber Co.

MOULTRIE, Colquitt County
Ladson Lbr. Co.
Morris Brothers

MT. VERNON, Montgomery County
Johnson, W. A.

NEWNAN, Coweta County
R. D. Cole Mfg. Co.

NORCROSS, Gwinnett County
Flowers, W. D.
Gastley, C. E.
Green, J. C.
Litsch, W. R.

OAKFIELD, Worth County
Nation, J. A.

OCHLOCHNEE, Thomas County
Mason Lumber Co.

OCILLA, Irwin County
Willis Lbr. Co.

OCONEE, Washington County
Ennes, E. N.
Hodges, C. M. & Sons

ODESSADALE, Meriwether County
Glanton, W. A.

ODUM, Wayne County
Brentwood Lbr. Co.
Thompson Bros.
Warren, R. E.

OFFERMAN, Pierce County
Thomas, R. J.

OGEECHEE, Screven County
Fetty, I. H.

OGLETHORPE, Macon County
Cobb Lbr. Co.
Flint Lbr. Co.

OLIVER, Screven County
Barber, W. W.
Colson, J. L. & Son

OXFORD, Newton County
Dial, C. B.

PELHAM, Mitchell County
Whaley, A.

PEMBROKE, Bryan County
Bowen, L. S.
Parrish, W. W.

PINEORA, Effingham County
Pineora Mfg. Co.

POWDER SPRINGS, Cobb County
Boynton, R. A.
Florence, W. L.
Smith, J. F.

PRESTON, Webster County
Cagle, W. W.
Montgomery, G. A.
Patterson & Davis
Rees, J. O. & Sons
Sappington & Averett

QUITMAN, Brooks County
Shores, F. M. & Co.
South Georgia Lbr. Co.

RANGER, Gordon County
Earnest, G. C.

RESACA, Gordon County
Resaca Lbr. Co.

REYNOLDS, Taylor County
Saunders & Sealey

RICHLAND, Stewart County
Alexander & Bland
Bell Lbr. Co.
Dudley Lbr. Co.

RINGGOLD, Catoosa County
Catoosa Lbr. Co.
Clark, J. H.
Combs, C. M.
Creswell, W. O.
Embesson, T. S.
Hulsey & Combs
Vosburg, C. C.

ROBERTA, Crawford County
Starnes, W. C.

ROCKMART, Polk County
Davenport Bros.
Ezell, J. C.

ROSWELL, Cobb County
Maxwell, J. T.

ST. MARYS, Camden County
Lang, Walter

SANDERSVILLE, Washington County
Harrison, T. I.
Red Bird Lbr. Co.
Rough Diamond Lbr. Co.

SAVANNAH, Chatham County
Forester-Cunningham Lbr. Co.
Godley-Green Lbr. Co.
Liberty Lbr. Co.
Mead & Manucy
Reynolds & Manley Co.
Savannah River Lbr. Co.
Smith, W. W. Lbr. Co.
Southern Lbr. Co.
Stovall, W. I.

SCOTLAND, Telfair County
Wilks Brothers

SENOIA, Coweta County
Nations, T. D.

SHARON, Taliaferro County
Flynt & Moore

SHELLMAN, Randolph County
Church-Robinett Lbr. Co.

SILOAM, Green County
Boswell, E. T., Co.

SMITHVILLE, Lee County
Fite, J. B.
Lee County Lbr. Co.

SOPERTON, Treutlen County
Fowler, James

SPARKS, Cook County
Stutts & Daugherty

SPARTA, Hancock County
Archer, J. M.
Ethridge Lbr. Co.

STATESBORO, Bulloch County
Howard, Arthur

STEVENS POTTERY, Baldwin County
Weaver, W. T.

STILSON, Bulloch County
Brown-Bland Lbr. Co.
Zickgraf Lbr. Co.

SUMMERVILLE, Chattooga County
Edwards, Daniel

SUWANEE, Gwinnett County
Jones, Gus

SWAINSBORO, Emanuel County
Lamb, T. D.
Swainsboro Lbr. Co.

SYLVANIA, Screven County
Brantley, W. L.
Mallory Bros.
Perkins, M. & H.
Sylvania Lbr. Co.
United Lbr. & Timber Co.
White, J. C.

SYLVESTER, Worth County
Simmerly & Lawrence

TALBOTTON, Talbot County
Carlisle, J. B.
Hampton Lbr. Co.
Southmont Mfg. Co.

TALKING ROCK, Pickens County
Talking Rock Mfg. Co.

THOMASTON, Upson County
Garner, Green & Matthews
King and Thurston
Perkins, J. T.

THOMASVILLE, Thomas County
Kirby Planing Mill Co.
Houston Lbr. & Tie Co.
McCallum, P. J. Co.
Turner, J. L. Co.
Upchurch, W. J.
Williams, Homer

THOMSON, McDuffie County
Bowden, Paul A.
Bowden-Kunnes Lbr. Co.
Knox Lbr. Co.
Lovelace-Brown Lbr. Co.

TIFTON, Tift County
Coarsey Lbr. Co.
Postell Lbr. Co.

TIGNALL, Wilkes County
Savannah Valley Lbr. Co.
Seymour, J. W.

TOOMSBORO, Wilkinson County
Lord, J. T., Jr.
Lovelace-Eubanks Lbr. Co.

TRENTON, Dade County
Morrison & Pace

UNADILLA, Dooly County
King Lbr. & Oil Co.

UVALDA, Montgomery County
Johnson, W. A.
McArthur, J. J.

VALDOSTA, Lowndes County
Baker & Co.
Bray, J. N., Lbr. Co.
Downer Lbr. Co.
Jackson Bros. Lbr. Co.

VILLA RICA, Carroll County
Henslee, A.
Neal & Manor

WADLEY, Jefferson County
Middle Georgia Lbr. Co.
Warm Springs Planing Mill

WARRENTON, Warren County
Bostonville Planing Mill Co.
McBrayer Lbr. Co.
Shelton, W. T.
Thompson, E. J.

WARSAW, McIntosh County
Warsaw Lbr. Co.

WARTHEN, Washington County
Rachel, A. P. & Bro.
Warthen Lbr. Co.

WARWICK, Worth County
Whitfield, L. C.

WASHINGTON, Wilkes County
Mauney, Frank L.
Pope Lbr. Co.
Scott-Strother Lbr. Co.
Washington Mfg. Co.

WAVERLY HALL, Harris County
Waverly Hall Lbr. Co.

WAYNESBORO, Burke County
Claxton, R. L.
Green Bros.
Waynesboro Planing Mill

WAYSIDE, Jones County
Wood, J. D.

WEST POINT, Troup County
Batson-Cook Co.

WESTON, Webster County
Weston Lbr. Co.

WHITE, Bartow County
Starr, J. W. & Sons

WHITE PLAINS, Green County
Taylor Bros.

WHITESBURG, Carroll County
Duncan, C. A.
Edgeworth, W. F.

WILLACOOCHEE, Atkinson County
Doster & Ladson

WINDER, Bartow County
Jones, W. J.
Millsaps, G. S.

WOODSTOCK, Cherokee County
Poor, A. F.

WOODVILLE, Green County
Moody, C. G.

WRENS, Jefferson County
Wren Bros.
Wren, R. A.

WRIGHTSVILLE, Johnson County
Jackson, M. A.
Keel Lbr. Co.
Lovett, W. H., Lbr. Co.
Rowland, R. H.
Smith, R. H.

YATESVILLE, Upson County
Brown, W. M.

GEORGIA LUMBER, MILLWORK AND BUILDING MATERIAL DEALERS

ACWORTH
Carruth Gin & Lbr. Co.
McClure & Fowler

ADAIRSVILLE
Cedar Springs Mfg. Co.
Shaw Lbr. Co.

ALBANY
Hedges Builders Supply Co.
Home Builders Supply Co.
The Ross Co.
W. A. Stokes

AMERICUS
Americus Construction Co.
W. W. McNeill Lbr. Co.
J. W. Shiver

ASHBURN
C. E. Thrasher

ATLANTA
Addison-Rudesal
Atlanta Aggregate Co.
Atlanta Oak Flooring Co.
Campbell Coal Co.
Carolina Portland Cement Co.
Cleveland-Oconee Lbr. Co.
Cromer & Thornton, Inc.
Deckner-Willingham
DeJarnette Supply Co.
W. B. Disbro Lbr. Co.
East Side Coal & Lbr. Co.
Gresham Mfg. Co.
Dan Klein & Son
V. H. Kreigshaber & Son
Imperial Pine Corporation
Frank G. Lake
Marbut-Williams Lbr. Co.
Miller Lbr. Co.
Pattillo Lbr. Co.
Patterson Lbr. Co.
Phoenix Planing Mill
Randall Bros., Ins.
Smith & Simpson Lbr. Co.
J. W. Starr & Son
A. C. Walters
E. G. Walton
West Lbr. Co.
Williams Bros. Lbr.
Williams-Flynt Lbr. Co.
Willingham-Tift Lbr. Co.
Womack Lime & Cement Co.

ATHENS
Carter-Moss Lbr. Co.
The Dozier Co.
R. L. Moss Mfg. Co.

AUGUSTA
Augusta Building Supply Co.
Augusta Lbr. Co.
Burum Co.
Perkins Mfg. Co.
D. Slusky & Son
Whaley Bros.
Woodward Lbr. Co.
Youngblood Builders Supply Co.

AUSTELL
R. M. Brown

BALL GROUND
Wheeler Lbr. Co.

BAGDAD
W. P. Nutt
Bagdad Land & Lbr. Co.

BAINBRIDGE
J. G. McKenzie
Ramsey-Wheeler Co.

BAXLEY
R. E. Jarman & Sons

BLACKSHEAR
J. B. Truett Co.

BLAKELY
Hall Lbr. Co.

BLUE RIDGE
M. K. McKinney

BOSTON
Boston Lbr. Co.

BRASELTON
Braselton Improvement Co.

BREMEN
E. C. Wilson
J. W. Wood

BRENTWOOD
Brentwood Lbr. Co.

BRUNSWICK
Bladen Tie & Lbr. Co.
Brunswick Lbr. & Supply Co.
Brunswick Peninsula Co.
Coney & Barker Co.
Glynn Lbr. Co.
Lang Planing Co.
Lumber Supply Co.

BUFORD
Bona Allen, Inc.
W. G. Deaton
L. E. Strickland

CALHOUN
Calhoun Lbr. Co.

CANTON
Jones Mercantile Co.

CARROLLTON
Carrollton Hardware Co.
J. L. Kaylor
D. F. New

CARTERSVILLE
Knight Mercantile Co.
Smith Lbr. Co.

CASSANDRA
Clark & Tucker

CEDARTOWN
J. W. Dingler
Hightower Lbr. & Supply Co.

CHAMBLEE
Chestnut & Nash

CHATSWORTH
Empire Talc & Lbr. Co.

CLARKESVILLE
W. A. Church
Hill Planing Co.

CLAYTON
P. A. Hunter

COLLEGE PARK
College Park Supply Co.
Creel Lbr. Co.

COLUMBUS
Butts Lbr. Co.
Carter Lbr. Co.
Cooper Lbr. Co.
Dudley Sash & Door Co.
Harvey Lbr. Co.
Williams Lbr. Co.

COMER
Gholston Bros.

COMMERCE
Commerce Brick & Lbr. Co.

CONYERS
W. R. Still

CORDELE
Cordele Sash & Door Co.
Crisp Lbr. Co.

CORNELIA
Cornelia Hardware Co.
Gallaway & Hopper
Holbrook Hardware Co.

COVINGTON
S. H. Adams

CRAWFORDVILLE
C. H. Golucke & Son

CUTHBERT
Cuthbert Coal & Wood Co.

DALLAS
Dallas Milling Co.
Lee Hardware Co.

DALTON
Acme Lbr. Co.
Cherokee Mfg. Co.
Farrar Lbr. Co.

DAWSON
Dawson Variety Works
D. H. Rowland & Son
Shields-Geise Lbr. Co.

DECATUR
DeKalb Supply Co.

DOUGLAS
Pat Darby Lbr. Co.

DOUGLASVILLE
W. C. Abercrombie
J. W. House & Sons

DUBLIN
Dublin Sash & Door Co.
J. M. Dettys Lbr. Co.
E. B. Mackey Lbr. Co.
McDaniel & Mackey

DULUTH
I. M. Suddeth

EASTMAN
Nicholson Lbr. Co.

EAST POINT
East Point Lbr. Co.

EATONTON
C. M. Hudson

EDISON
W. E. Pierce

ELBERTON
Herndon & Smith

ELLA GAP
Davis Brothers

EASTPORT
Brooks-Scanlon Corporation

FAIRBURN
Johnson & Co.

FARMINGTON
H. T. Murrow

FAYETTEVILLE
Redwine Brothers

FITZGERALD
Standard Supply Co.

FORSYTH
Forsyth Coal & Lbr. Co.
Webb Lbr. Co.

FORT GAINES
Kellingsworth Hardware Co.
Ross Hardware Co.
Georgia Basket & Lbr. Co.

GAINESVILLE
C. M. Chambers

FORT VALLEY
Davis-Washington Co.

GAY
Gay & Keith

GEORGETOWN
Pine Lbr. Co.

GRANTVILLE
Grantville Lbr. Co.

GREENSBORO
McCommons-Thompson Boswell Co.

GREENVILLE
Builders Supply Co.

GRIFFIN
Gresham Mfg. Co.
Griffin Lbr. Co.
Newton Coal & Lbr. Co.
Robt. Wheaton & Sons

HAMPTON
Henderson Coal & Lbr. Co.

HARTWELL
D. C. Alford
J. W. Temple & Sons

HAWKINSVILLE
W. D. McEachern

HELEN
Morse Bros. Lbr. Co.

HOGANSVILLE
Johnson Lbr. Co.

HOWARD
J. J. & C. H. Edwards

JACKSON
H. T. Gilmore
W. P. Nutt

JEFFERSONVILLE
Whitaker Lbr. Co.

JONESBORO
W. H. Turnipseed

LAFAYETTE
Chas. Clemons
John Howard
LaFayette Coal & Wholesale Co.
E. A. Puryear
Quillian & Clemons

LAGRANGE
Daniel Lbr. Co.
LaGrange Lbr. & Supply Co.

LAVONIA
Harbin Bros.
L. O. Mauldin

LAWRENCEVILLE
E. B. Rockmore

LILLY
Ricks Lbr. Co.

LITHIA SPRINGS
P. H. Winn

LITHONIA
A. J. Almand & Co.

LOCUST GROVE
R. H. & M. M. Brown
A. G. Combs

LOGANSVILLE
Logansville Lbr. Co.

MACON
Bibb Lbr. Co.
Builders Lbr. Co.
T. C. Burke, Inc.
Case-Fowler Lbr. Co.
Central City Lbr. Co.
Central Sash & Door Co.
Chambers Lbr. Co.
E. J. Hancock
James Lbr. Co.
Macon Supply Co.
J. W. McCook Lbr. Co.
C. J. Molton Lbr. Co.
The Ross Co.
Willingham Sash & Door Co.

MADISON
Farmers Hardware Co.

MANCHESTER
J. P. Corley Lbr. Co.

MANSFIELD
Mansfield Lbr. Co.

MARIETTA
Black Builders Supply Co.
McNeel Lbr. Co.
Stephens Lbr. Co.

MAXEYS
A. T. Brightwell & Sons

McDONOUGH
Berry Lbr. Co.
Carmichael Lbr. & Coal Co.
Planters Warehouse & Lbr. Co.

METTER
Metter Lbr. Co.

MIDVILLE
M. D. Jones

MILLEDGEVILLE
Bland Lbr. Co.
Fowler-Flemister, Inc.

MILLEN
Builders Supply Co.

MINERAL BLUFF
R. W. Nichols

MONROE
Langston Lbr. Co.
W. H. Nunnally
McKenzie Lbr. & Supply Co.

MONTICELLO
R. L. Marsh
Builders Supply Co.

MORELAND
Cureton-Cole Co.

MOULTRIE
Colquitt Lbr. Co.
Davis-Jenkins & Sons
Ladson Lbr. Co.
Johnson-Battle Lbr. Co.

OCILLA
C. O. Betts

OCHLOCHNEE
Tyson Lbr. Co.

PALMETTO
F. H. Redwine Co.

PELHAM
Whaley Bros.

PERRY
Perry Warehouse Co.

POWDER SPRINGS
M. A. J. Landers

QUITMAN
King Lbr. & Remilling Co.
South Georgia Lbr. Co.

RANGER
G. C. Earnest

RINGGOLD
J. H. Clark

ROCKMART
Davenport Brothers

ROME
Chenoweth-Holder Lbr. Co.
H. J. Keown Lbr. Co.
Marshall Mfg. Co.
O'Neill Lbr. & Box Mfg. Co.

ROSWELL
I. M. Roberts

ROYSTON
Harbin Bros.

SANDERSVILLE
C. A. Adams
Lang's Variety Works

SASSER
J. M. Barner

SAVANNAH
A. S. Bacon & Sons
Atlantic Long & Export Co.
W. J. Bremer
Burns & Harmon
Bright-Brooks Lbr. Co.
John G. Butler Co.
Forest Purchasing Co.
General Building Supply Co.
J. L. Highsmith
Neal & Blun Co.
Penn Waller Lbr. Co.
Quarterman & Ellis
Savannah Planing Mill
Savannah River Lbr. Co.
Stevens Supply Co.
Dan Shehan
Julian A. Tison's Sons

SOCIAL CIRCLE
Wallace-Cowan Lbr. Co.

SPARTA
Sparta Lbr. Co.

STATHAM
J. S. Holliday

STOCKBRIDGE
J. W. Patillo

SWAINSBORO
J. R. Coleman
J. W. & C. I. Hall

SYLVANIA
Jenkins Mfg. Co.
M. & H. Perkins

SYLVESTER
Hillhouse Hardware Co.
Shell Lbr. Co.

TALBOTTON
Jordan Supply Co.

TALKING ROCK
L. A. Silver

TALLULAH LODGE
J. E. Harvey

THOMASTON
Alvan Nelson Lbr. Co.
Paul Johnston Lbr. Co.
Thomaston Lbr. Co.

THOMASVILLE
W. E. Beverly
L. F. Driver & Co.
Kirby Planing Mill
Thomasville Variety Works

THOMSON
Knox Hatcher Lbr. Co.
Thomson Builders Supply Co.

TIFTON
Goodman Golden Lbr. Co.
Wilder Lbr. Co.

TOCCOA
Ramsey-Martin Hardware Co.

UNION CITY
Union City Lbr. Co.

UNION POINT
Stewart & Ruthford

VALDOSTA
The J. N. Bray Co.
Briggs Hardware Co.
Eva Lbr. Co.
Ga. Fla. Lbr. Co.
Georgia Lbr. & Supply Co.
Jackson Bros.
Larsen & Forbes Hardware Co.
Nolan Lbr. Co.
Paine Hardware Co.
Stump Bros.
Strickland Hardware Co.
Valdosta Builders Supply Co.

VIDALIA
J. T. Regan & Co.

VIENNA
J. B. Peavy

VILLA RICA
O. B. Camp
Cleghorn Bros.

WARRENTON
F. L. Howell
D. L. Stone

WASHINGTON
Washington Mfg. Co.

WATKINSVILLE
Nicholson & Ward

WAVERLY HALL
Pitts Lbr. Co.

WAYCROSS
Enterprise Mfg. Co.

WAYNESBORO
Builders Supply Co.
Neely Builders Supply Co.

WEST POINT
West Point Coal & Lbr. Co.
West Point Iron Works

WINDER
New Windsor Lbr. Co.

WOODBURY
Anthony Lbr. Co.

ZEBULON
Tidwell Lbr. Co.

Georgia Forest Service

B. M. LUFBURROW, *State Forester*

Jan., 1930 | ATLANTA, GEORGIA | Bul. 5

Uses of Georgia Woods

With Directory of Wood Manufactures, Saw Mills and Dealers in Lumber and Mill Work Materials

(Second Edition)

By

CHARLES A. WHITTLE
Director of Education and Utilization

PROTECTION
CONSERVATION
PERPETUATION

GEORGIA
FOREST SERVICE

Uses of Georgia Woods

The value of Georgia's wood products in 1925, as given by the United States Census, was $122,000,000. From the state's 23,000,000 acres in forests it is possible to grow trees that can be utilized to produce commodities worth annually more than $122,000,000. To do this, the landowners must manage the forests so that they will produce the maximum wood growth. This means that the landowner must protect the forest from fire, thin it properly, harvest mature trees and otherwise practice good forest management.

But to realize the full value of the state's forest resources there should be a full appreciation of the uses of its various woods.

Each year large quantities of building material are shipped into Georgia that could as well have been supplied by Georgia forests. For instance, white pine, not grown in appreciable amounts in the South, is often specified for frames, doors and sash for Georgia structures, whereas cypress, yellow pine and other southern woods could be used.

Georgia has a wealth of trees desirable for use in interior finishing which it is not using to the greatest advantage. Nothing is more beautiful and suitable for interior finishing than red gum, black walnut and magnolia. Cypress, chestnut, oaks and other trees grown in this state also lend themselves to this purpose. Yet quite a good deal of money is spent annually for this class of material produced in other sections of the country.

In the hope of aiding the forest owner to a better understanding of his forest resources and his market, and in the hope of stimulating larger demands for Georgia's woods, this publication presents brief statements of the character and uses of *leading commercial woods* of the state, and also a list of leading saw mills, woodworking plants and lumber dealers of Georgia.

Fire Protection Essential

Too much stress can not be laid on forest fire prevention as an essential to growing trees with reasonable rapidity and for producing sound lumber. When fire passes through a Georgia forest as a rule the flames consume only the leaves and debris on the forest floor and scar the butts of the large trees. But sometimes when there is considerable debris such as is usually left after a logging operation, the flame are so intense as to kill a part or all the trees.

Even when the fire is of the ordinary kind that does not kill the larger growth, the harm resulting is that (1) seedlings are killed; (2) the humus that is an important source of tree plant food is destroyed, thus starving the trees and slowing down their rate of growth; (3) the mulch covering the forest floor that absorbs and conserves the rainfall needed for tree growth is consumed.

Fires burn the trunks of trees destroying some of the tissue needed in carrying plant food up from the soil. Decay enters these scars and penetrates to the heart of the trunk, causing hollow places and destroying the best lumber in the tree.

The weakening of trees resulting from decreased supply of plant food and moisture and the decay that the fires are responsible for, cause trees to be more susceptible to insect and disease injury. This means destruction of wood or impairment of the quality of the lumber.

The Georgia Forest Service is undertaking through various means to educate the public to an appreciation of the meaning of forest fires. It has its timber protective organizations through which federal aid is extended; it is cooperating with 100 rural high schools in conducting demonstration forests that teach methods of fire control; it cooperates in putting on moving pictures that teach forest fire prevention to rural schools throughout the state; it has prepared and distributed forest fire posters: carries on campaigns through newspapers and with every opportunity representatives of the Georgia Forest Service

talk to audiences and speak to individuals about keeping fires out of the forests. It is a campaign that everyone is invited to join and urged to wage in Georgia.

Leading Woods of Georgia and Their Uses

Descriptions of leading woods of Georgia and statements of their main uses are given below. Other uses than those mentioned may exist and still others may be developed.

Pines

Loblolly (*Pinus taeda.*) Found most abundantly in upper coastal plain and lower Piedmont. In the market it is included in the class of "yellow pine." The grain is coarser than longleaf pine and the wood is lighter and softer. It is used for building materials, box shooks, barrel staves, basket veneer, pulpwood, lath, mine props, piling, crossties, telephone poles when creosoted; for excelsior and sometimes for turpentining though the yield is poor.

Longleaf Pine (*Pinus palustris.*) It is prevalent in the coastal plain and scattered in comparatively small quantities in the Piedmont area. The wood is heavy, hard, strong, nearly all heart, and is quite durable. It is used for all kinds of building material and because of its strength it is used for long timbers in construction work of buildings, bridges, columns, masts, spars, etc. It is also used as crossties, posts, mine prop, log cabins, staves, shingles, and palings. Creosoted blocks of longleaf pine are used for paving. The dead leaves (pine straw) are employed for making baskets and fancy holders of various kinds. Its gum is used for naval stores—that is, turpentine, rosin, tar, etc. This is obtained not only by chipping off the bark and collecting gum, but by distilling stumps, roots and tree tops left after logging. A fibre residue of the distillation

process is used for packing purposes and for making wall board. The pine needles or leaves are used for making baskets and mats and for charcoal production.

SLASH PINE (*Pinus caribaea.*) Slash pine is found in the coastal plain and predominates over the longleaf on low, moist lands. It grows more rapidly than longleaf for the first thirty years. The wood is heavy, hard, strong, tough and durable. It is highly resinous and is a heavy yielder of naval stores products. Its wood and leaves are adapted very generally to the same purpose ascribed to longleaf pine.

SHORTLEAF PINE (*Pinus echinata.*) This variety predominates in the mountainous section and is found quite generally in the Piedmont area. The wood is moderately hard and strong, its color yellowish to dark brown. It is manufactured into lumber, boxes, crates and other containers. It is in demand for woodpulp, veneers, excelsior, cooperage and mine props.

BLACK PINE (*Pinus serotina.*) This is sometimes called pond pine and pocosin. It grows in low, swampy, sour lands of the coastal plain. While inferior to longleaf in quality of lumber it is generally accepted as "yellow pine" by the trade. The wood is heavy, coarse-grained, orange to pale yellow in color with abundant sapwood. It can be used as other pines described for most types of construction.

OTHER CONIFERS. A limited amount of white pine, hemlock, scrub and pitch pine is found in the mountainous part of the state. White pine is in ready demand for building purposes. The other pines will probably find their greatest use in the production of wood pulp.

OAKS

WHITE OAK (*Quercus alba.*) The white oak is common to all parts of the state. Its wood is durable, tough, strong, elastic and straight grained, qualities that recommend it for many uses, such as beams, furniture, book cases, vehicles, tight cooperage, interior finish, baskets, splint bottomed chairs, cross-

ties, fence posts, etc. Its acorns make good hog feed. The inner bark of young trees is distilled for medicinal purposes.

POST OAK (*Quercus stellata.*) This tree is widely distributed over the state. Its wood is light to dark brown, hard, close-grained, durable in contact with the soil. It is used for many of the purposes to which white oak is put such as furniture, interior finish, beams, crossties, fence posts and flooring, but the lumber is not considered quite as good as white oak. It makes fairly good staves.

SOUTHERN RED OAK (*Quercus rubra.*) This is also called Spanish oak, and grows widely over the state. The wood is hard, strong, coarse-grained, not durable. The wood is light red. It is used for rough furniture, general construction, crossties, interior finishing and cooperage. Its bark is used for making tannin.

NORTHERN RED OAK (*Quercus borealis*) is scattered through the state, but is most common in the mountains. It is used for cooperage, interior finish, general construction, furniture, crossties, etc.

BLACK OAK (*Quercus velutina.*) This tree is also called yellow oak and grows extensively over the state. Its wood is bright reddish-brown with a thin layer of paler sapwood. It is sold as "red oak" and used for the same general purposes. The bark is used to produce a yellow dye and is also used for making tannic acid.

WATER OAK (*Quercus nigra.*) Water oak grows along streams, in bottom lands and along borders of swamps. The wood is light-brown, heavy, hard and strong. It is used for crossties, pilings and fuel, and is favored for planting as a shade tree.

Other oaks belonging to the water oak class and similarly used are the laurel oak (quercus laurifolia) and willow oak (quercus phellos).

CHESTNUT OAK (*Quercus montana.*) This tree is widely distributed in the mountainous section of the state, especially on rocky, gravelly slopes. Its wood is heavy, hard, strong and durable in contact with soil, ranking close to white oak. It is used for crossties, bridge timbers, fence posts and rough construction. Its bark is preferred to all other oaks for its tannic acid.

SWAMP CHESTNUT OAK (*Quercus prinus*) sometimes called "basket oak" because it is adapted to making baskets, and sometimes called "cow oak" because its leaves are eaten by cows. It is sparsely distributed. It makes excellent wood, with uses similar to white oak; in fact, is sold as white oak.

LIVE OAK (*Quercus virginiana.*) This variety is abundant in the coastal plain. The wood is heavy, tough, hard, nearly white. It was formerly used extensively as "ship knees." It is used for mauls, rollers, meat blocks, wood pulp and veneer. The sweet kernel of its nut makes it palatable. Indians boiled and parched it and ate it as bread.

OTHER OAKS. Turkey oak (*Quercus catesbaei*) is a common oak of the coastal plain dry ridges and hammocks. It is used to some extent as rough lumber and general construction. Scarlet oak (*Quercus coccinea*), sometimes called pin oak, widely distributed but sparse, is sold as red oak and is also planted as shade trees. Black Jack oak (*Quercus marilandica*) is found in all parts of the state. Its only use at present is for fuel.

TULIP (POPLAR)

YELLOW POPLAR (*Liriodendron tulipifera.*) This valuable tree grows in all parts of the state, reaching its greatest growth in rich cove lands of the mountains. Its wood is light yellow or brown; light, soft and easily worked; put to a great variety of uses, such as building materials, exterior and interior, veneers, vehicle bodies, turnery, woodenware, furniture, imitation ma-

hogany veneer, excelsior, boxes, crates, porch columns, shingles, baskets, woodpulp, crossties, etc.

Cypress

Cypress (*Taxodium distichum*) is found in the lower coastal plain in deep swamps and in low, moist lands along streams. The wood is light and soft but very durable. Its color varies from light sapwood to dark brown heartwood. The wide adaptability of this wood makes it economically very important. Its durability under exposure and contact with soil makes it very desirable for sash, doors, frames, blinds; for piles, crossties, tanks, telegraph poles, shingles, water pipes, silos, buckets, churns, freezers, boats, greenhouse frames, etc.

Gums

Red Gum (*Liquidambar styraciflua.*) This tree is also known as "sweet gum." It is widely distributed over the state and in recent years has become one of the valued woods. The heartwood is reddish brown and the sapwood of lighter color. The wood is close-grained, moderately hard, heavy. It lends itself to interior uses in the place of Circassian walnut, which with proper treatment, it very closely resembles and, by many, considered more beautiful. It also can be stained to resemble mahogany. It should be more generally used for furniture, desks, cabinets, doors, interior finishings of homes and store buildings; for gun stocks, boxes, floors, woodpulp, etc.

Black Gum (*Nyssa biflora*) is a different species of tree from red gum. It is also called sour gum and bee gum, and is found in great abundance in low, wet lands and swamps over the state. The wood is tough, cross-grained. It is used for crate and basket veneers, box shooks, rough floors, rollers, mallets, mauls, hubs, woodpulp, etc. A variety of black gum

(nyssa sylvatica) is common on dryer lands and very similar in appearances and uses to black gum above described. In fact, it is not generally regarded as being different from it.

TUPELO (*Nyssa aquatica, Nyssa uniflora Wang*), sometimes sold as bay poplar, is native to swamps. Formerly considered worthless as lumber, but with improved method of curing it has become useful in all lines in which yellow poplar is used. On account of its freedom from splintering it is desirable for flooring of warehouses and freight platforms. Its chief uses are for veneer for boxes, crates, etc. Cigar boxes and musical instruments are made of it.

CHESTNUT

CHESTNUT (*Castanea dentata*) is native to the mountain and Piedmont region. On account of the spread of chestnut blight against which no defense has been found, this tree is threatened with extinction. It is, therefore, important to utilize it to the fullest extent before it is killed. The wood is soft, light, straight-grained and very durable in contact with the soil. It can be used for a large number of purposes, such as interior finish, sash, doors, frames, sheeting, crossties, telephone poles, posts and shingles. Both wood and bark are in demand by tanneries.

CEDAR

RED CEDAR (*Juniperus virginiana*) is found in all parts of the state. The heart wood is quite red and the sapwood white, this contrast adding to its attractiveness. The wood is strong, soft, with straight grain. Its adaptability to lead pencils is unsurpassed. On account of its durability, cedar has been favored for telephone and telegraph poles and fence posts. Sawed into lumber it finds popularity in the production of clothes chests, for lining of closets, for interior finishings of rooms, etc. A valuable oil is made from the wood and green twigs.

WHITE CEDAR (*Chamacyparis thyoides*) is common to South Georgia swamp lands or "glades." The wood is soft, close-grained, slightly aromatic. It is in demand for cooperage, shingles, fence posts, boats, telephone and telegraph poles, etc.

WALNUT

BLACK WALNUT (*Juglans nigra*) is found growing on rich lowlands and fertile hillsides in various parts of the state. Its wood is hard, strong, heavy, close-grained and susceptible of high polish. The color of the wood of old trees is a rich chocolate brown. The wood is highly valued for furniture, desks, cabinets, interior finishing, gun stocks, sewing machines, musical instruments and airplane propellers. Black walnut lumber brings the highest price of any Georgia grown wood. The nuts are a source of revenue and the hulls of the nuts were formerly used for making a dye for homespun cloth.

WHITE WALNUT (*Juglans cinera*), sometimes called butternut. It is found only in the mountains where it is quite common. The wood is light brown, light, soft, coarse-grained, not strong. It takes a high polish and is used for interior finishing and furniture. A yellow or orange dye is made from the hulls of the nut.

HICKORY

WHITE HICKORY (*Carya alba*)—also known as white-heart hickory and mockernut hickory, has a wood very hard, heavy, strong, tough and pliable. The heartwood is light brown to reddish with rather wide margin of white sapwood, not durable in contact with the soil. It is common to all well-drained soils throughout the State. Its wood is used for vehicles, tool handles, athletic goods, for smoking meats, etc.

SCALY-BARK HICKORY (*Carya ovata*) is found along streams and rich moist hillsides throughout the state. The wood is heavy, strong, hard, tough and flexible and is used for tool

handles, vehicles and many other ways where strength and flexibility of woods are desired.

The wood of all hickories is used for very much the same purposes. Other hickories found widely over the state are: Pignut Hickory (Carya Glabra), found mainly in middle Georgia, and Bitternut Hickory (Carya Minima), scattered over the state, having reddish-brown wood somewhat inferior to other hickories. Less important commercially are Swamp Hickory (Carya Aquatica) and Pecan (Carya Pecan).

Ash

WHITE ASH (*Fraxinus americana*) is common to all parts of the state. The wood is white to brown in color and is highly prized because of its toughness and elasticity, and for this reason is used for handles for athletic goods such as rackets, bats, oars, and for vehicles, furniture, interior finish, etc.

WATER ASH (*Fraxinus caroliniana*) and GREEN ASH (*Fraxinus pennsylvanianca lanceolata*) appear over the state, but are not equal to white ash and are not abundant enough to be of much commercial importance.

Cherry

WILD CHERRY (*Prunus serotina*), also called Black Cherry, reaches greatest development in the mountainous portion of the state. The wood is reddish-brown, close-grained and hard and takes a beautiful finish. It is highly prized for interior finish, cabinet making, veneer, panels, etc. Next to walnut, it brings the highest market price of any wood in eastern United States. Its bark is used for medicinal purposes, especially in cough medicines.

Beech

BEECH (*Fagus grandifolia*) grows throughout the state usually in association with hickories and oaks on rich moist

land, its greatest development being in mountain coves. The wood is hard, light red in color, strong, tough, but is not durable when exposed to weather or soil. It is used for flooring, tools, novelty wares, charcoal, crates, veneer, bobbins, clothes pins, shoe lasts, boxes, handles, etc.

BLUE BEECH (*Carpinus caroliniana*), also called water beech, is found along streams throughout the state and is not abundant enough to be of much economic value. Its wood is used for tool handles, wooden cogs, mauls, wedges and levers.

HORNBEAM (*Ostrya virginiana*), also called Ironwood, is used in the same manner as beech.

LOCUST

BLACK LOCUST (*Robinia pseudacacia*), also known as yellow locust, found throughout the northern half of the state. The wood is yellow, coarse-grained and durable in contact with soil. It is prized as crossties, fence posts, telephone poles and insulator pins.

HONEY LOCUST (*Gleditsia triacanthos*), well known for its long pods, is scattered throughout the state. The wood is reddish-brown, not as durable as black locust, but is used successfully for fence posts, crossties and hubs. The pods provide food for hogs.

MAGNOLIA

MAGNOLIA (*Magnolia grandiflora*), a well-known evergreen, grows to large size in moist soils of coastal plains. Its cream colored wood is moderately heavy and hard. It is coming into popularity for interior finishing, veneer, basket and crate manufacture and kitchen furniture. It is an outstanding evergreen tree of the South for ornamental planting and is grown for such purposes far north of its natural habitat.

MOUNTAIN MAGNOLIA (*Magnolia fraseri*) grows in the mountainous portion of the state, but is not commercially important. It is used for lumber and pulpwood.

CUCUMBER TREE (*Magnolia acuminata*) is also a mountain member of the magnolia family. It is used for the same purposes as poplar, its cousin.

BASSWOOD-LINDEN

BASSWOOD and LINDEN (*Tilia*) are close kin, and the trade uses the names interchangeably. Trees of this kind are common to the mountains. Their wood is light brown, tough, cross-grained and used for woodenware, boxes, crates, millwork, picture frames, moldings, piano keys, bread-boards, ironing boards, excelsior and woodpulp. Formerly their tough barks were used for making ropes.

BIRCH

RIVER BIRCH (*Betula nigra*), also called Red Birch, is found along streams, ponds, in swamps and semi-swamp lands. The wood is close-grained and strong. It is used for woodenware, turnery, wagon hubs, hoops and handles.

BLACK BIRCH (*Betula lenta*) is also known as Sweet Birch and Cherry Birch. It occurs only in hills and mountains. The wood is heavy, strong, hard and compact. Its dark-brown color has given it a local name of "mountain mahogany." It is used as a substitute for mahogany in making furniture, interior finishing, flooring, etc.

HEMLOCK

HEMLOCK (*Tsuga canadensis*) is found in the mountains of Georgia. The wood is light, soft, brittle and splinters readily. It is used for coarse lumber and woodpulp. The bark is valued for its tannin.

CAROLINA HEMLOCK (*Tsuga caroliniana*) is also found in the mountains, and its wood and bark are used as described for Tsuga canadensis.

Sycamore

Sycamore (*Platanus occidentalis*), also called Buttonwood, grows throughout the state along streams and bottom lands. The wood is hard and moderately strong. Its chief uses are for butchers' blocks, tobacco boxes, interior finish, furniture and veneer.

Sassafras

Sassafras (*Sassafras officinale*) grows in all parts of the state on dry soils, but not in the higher mountains. Its wood is soft and brittle, but is durable in contact with the soil. It is used for posts, rails, cooperage, etc. The bark and roots are used to produce sassafras tea; also oil of sassafras employed for flavoring.

Willow

Black Willow (*Salix nigra*) is common along streams, ponds and in moist lands throughout Georgia. Its wood is soft, light, but not strong. It is employed in making artificial limbs, high-grade charcoal, excelsior, boxes and crates. The twigs are plaited to protect river banks from erosion. Its bark contains salicylic acid which is used for medicinal purposes.

Cottonwood (*Populus deltoides*), sometimes referred to as Carolina poplar, is scattered widely over the state, nowhere abundant. The wood is soft, light-weight, warps, but finds several uses such as substitutes for yellow poplar and linden, and converted into wood pulp makes high-grade paper.

Swamp Cottonwood (*Populus heterophylla*), Silverbell, is common along borders of rivers and swamps in the coastal plain region. The wood is light and soft. It is used for veneer, wood pulp and excelsior.

Maple

Red Maple (*Acer rubrum*) is known also as Swamp Maple, and is widely distributed through the state. Its wood is

sold as "soft maple" and is used in the manufacture of furniture, flooring, woodenware, turnery and paper pulp.

SILVER MAPLE (*Acer saccharinum*) is found on moist lands and along streams. The wood is soft, smooth and rather brittle and is used for the same purposes as red maple.

PERSIMMON-DOGWOOD-HOLLY

PERSIMMON (*Diospyros virginiana*) is found throughout the state. The wood is hard, dense, strong. The color of the heartwood is brown to black, the wide sapwood, white or yellowish. The wood is used for the manufacture of shuttles, bobbins, etc., in connection with knitting mills. The fruit is high in sugar content and valuable as food for man, game, hogs and cattle.

DOGWOOD (*Cornus florida*) is in great demand by cotton mills for the same purposes as persimmon. It is used for turnery, handles, forms, novelties, etc.

HOLLY (*Ilex opaca*), while regarded as having its greatest value as a source of holiday greens, it is sometimes cut and used for cabinet work, wood-turning, etc.

Directories

Wood Manufacturers, Saw Mill Operators and Lumber Dealers of Georgia

(In making up the following directories all available sources of information have been consulted, such as associations membership and other trade directories. It is possible that in spite of all our efforts some names may have been omitted. Any information that will help make the directories more complete will be welcomed for use in future issues of this bulletin.)

CHIEF ARTICLES MANUFACTURED FROM WOOD IN GEORGIA AND NAMES OF LEADING PRODUCERS

AGRICULTURAL IMPLEMENTS:

Athens Foundry & Machine Works, Athens
Atlanta Plow Co., Atlanta
Benton Manufacturing Co., Monticello
Camp, E. N. & Son, Moreland
Gantt Manufacturing Co., Macon
Lilliston Implement Co., Albany
Southern Plow Co., Columbus
Tom Huston Mfg. Co., Columbus
Towers & Sullivan, Rome

AUTO BODIES:

Columbus Fender & Body Works, Columbus
Savannah River Lbr. Co., Savannah
Yancey Brothers, Atlanta

BASKETS:

Atlanta Woodenware Co., Atlanta
Georgia Basket & Lbr. Co., Brunswick
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Menlo Fruit Package Co., Menlo
Peerless Basket Co., Cuthbert
Pierpont Mfg. Co., Savannah

BEE HIVES:

Wilder, J. J., Waycross

BLOCKS:

Southern Wood Preserving Co., Atlanta

BOBBINS AND SHUTTLES:

Jordan Mfg. Co., Menticello
Norris Brothers, Macon

BOXES:

Acworth Building Supply Co., Acworth
Champion Box Co., Thomasville
Cohutta Lumber Co., Chatsworth
Cunningham-Wayne Box & Crate Co., Savannah
Davis-Corum Box & Lumber Co., Macon
Dawson Variety Works, Dawson
Dudley Sash, Door & Lbr. Co., Columbus
Elberta Crate Co., Bainbridge
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Glover Casket Co., Rome
Griffin Box Co., Griffin
Hightower Box & Tank Co., Atlanta
Jeffreys & McElrath Mfg. Co., Macon
Maxwell Brothers, Macon
Menlo Fruit Package Co., Menlo
Moultrie Box & Crate Co., Moultrie
Mutual Mfg. Co., Savannah
O'Neill Lumber & Box Mfg. Co., Rome
Pierpont Mfg. Co., Savannah
Reynolds Brothers Lbr. Co., Albany
Southern Novelty Works, Demorest
Union Box Mfg. Co., Atlanta

CAR BUILDERS:

Georgia Car & Locomotive Co., Atlanta

CARRIAGES:

Griffin Buggy Co., Griffin
Jones, J. W., Cartersville
Norman Buggy Co., Griffin
Smith, Jackson G. & Co., Barnesville

CASKETS:

Atlanta Casket Co., Atlanta
Capitol City Casket Co., Atlanta

CASKETS—Continued

Glover Casket Co., Rome
Columbus Cosket Co., Columbus
Juniper Casket Co., Juniper
Junction City Mfg. Co., Junction City
Maddox, B. R., Jesup
Mutual Mfg. Co., Savannah
McNatt Coffin & Casket Co., Vidalia
National Casket Co., Atlanta
Southland Casket Co., Atlanta
Warm Springs Planing Mills, Warm Springs

CHARCOAL:

Atlantic Turpentine & Pine Tar Co., Savannah
Valdosta Tar & Turpentine Co., Valdosta

COOPERAGE:

Armuchee Cooperage Co., Rome
Cannon, The Co., Cairo
Colquitt County Cooperage Co., Moultrie
Etowah Cooperage Co., Rome
Georgia Cooperage Co., Tallapoosa
Georgia Stave Co., Valdosta
Macon Cooperage Co., Macon
McElvey, O. A. & J. O., Pelham
Oak City Cooperage Co., Bainbridge
Reinschmidt Stave Co., Quitman
Southern Cotton Oil Co., Savannah
Southern Heading & Mfg. Co., Valdosta
Standard Stave Co., Cairo
Woolvin, R. B., Stave Co., Dublin
Youmans Stave Co., Adrian

COTTON GIN MACHINERY:

Cen-Tennial Cotton Gin Co., Columbus
Continental Cotton Gin Co., Columbus
Lummus Cotton Gin Co., Columbus
Massey Gin & Machine Works, Macon
Murray Company, Atlanta
Sea Island Cotton Gin Co., Vidalia

CRATES:

Champion Box Co., Thomasville
Cunningham-Wayne Box & Crate Co., Savannah
Elberta Crate Co., Bainbridge
Enterprise Mfg. Co., Waycross
Georgia Crate & Basket Co., Thomasville
Georgia Veneer & Package Co., Brunswick
Fort Valley Crate & Lbr. Co., Fort Valley
Multrie Box & Crate Co., Moultrie
Pierpont Mfg. Co., Savannah
Southern Crate & Veneer Co., Macon
Wilder Lumber Co., Tifton
Wadley Veneer & Basket Co., Wadley
Union Box Mfg. Co., Atlanta

CROSS TIES (R. R. Material):

Atlantic Tie & Timber Co., Savannah
Baxley Planing Mill, Baxley
Bladen Tie & Lumber Co., Brunswick
Chauncy, V. N., Jesup
Dicky, Lon, Fitzgerald
Houston Lbr. Co., Thomasville
Joyce-Watkins Co., Brunswick
Mutual Timber Co., Brunswick
Seals, C. N., Kingsland
Southern Tie & Timber Co., Atlanta
Stubbs & Stubbs, Douglas
Superior Pine Products Co., Fargo
Southern Wood Preserving Co., Atlanta
Werden-Empire Lbr. Co., Albany

DIMENSION STOCK:

Cleveland-Oconee Lbr. Co., Atlanta
Batson-Cook Co., West Point
Case-Fowler Lbr. Co., Macon
Green Bros., Waynesboro
Harrison, T. I., Sandersville
Massee & Felton Lbr. Co., Macon
Middle Ga. Lbr. Co., Wadley
Moore Lbr. Co., DeSoto
Stovall, W. I., Sautee
Savannah River Lbr. Co., Savannah
West, W. J., Lbr. Co., Rising Fawn

EXCELSIOR:

Augusta Bedding Co., Augusta
DuPre Mfg. Co., Atlanta
Georgia Cushion & Wrapper Co., Woodland
Wadley Veneer & Basket Co., Wadley

FIXTURES:

Commercial Mfg. Co., Atlanta
Cooper Lbr. Co., Columbus
Druger Mfg. Co., Atlanta
Macon Cabinet Works, Macon
Muecke & Sons Co., Macon
National Show Case Co., Columbus
Womack, J. P., & Sons, Atlanta

FLOORING:

Atlanta Oak Flooring Co., Atlanta
Karwisch, J. M., Wagon Works, Atlanta
Kriegshaber, V. H., & Son, Atlanta
Southern Wood Preserving Co., Atlanta

FURNITURE:

Arrimo Mfg. Co., Augusta
Austell Cabinet Co., Austell
Atlanta Table Co., Atlanta
Atlas Furniture Mfg. Co., Atlanta
Art Furniture Mfg. Co., Macon
Blanchard, Carter & Shebane, Crawford
Bellwood Novelty Works, Atlanta
Brumby Chair Co., Marietta
Bond & Waite Mfg. Co., Toccoa
Capitol City Chair Co., Atlanta
Chattahoochee Furniture Co., Flowery Branch
Coastal Cabinet Works, Brunswick
Carmichael Furniture Co., Atlanta
Carter Show Case Co., Atlanta
Cleveland-Oconee Lbr. Co., Atlanta
Currahee Furniture Co., Toccoa
Diana Furniture Co., Toccoa
Duane Chair Co., Dalton
Estes Wollcott Co., Rex
Floyd Brothers, Atlanta
Fox Mfg. Co., Atlanta
Geiger, W. T. P., Vidalia
Georgia Chair Co., Gainesville
Ginn Mfg. Co., Carnesville
Gholstin Spring & Mattress Co., Atlanta
Ideal Furniture Co., Athens

FURNITURE—Continued
Knott & Carmichael, Atlanta
Krueger Mfg. Co., Atlanta
Macon Cabinet Works, Macon
Macon Lbr. & Mfg. Co., Macon
Morrow-Cook Furniture Co., Albany
Muecke & Sons Co., Macon
Rome Cabinet Co., Rome
Rome Chair Co., Rome
Rome Furniture Co., Rome
Smith, Jackson G. & Co., Barnesville
Southern Desk & Table Co., Atlanta
Southern Novelty Works, Demorest
Spratt Chair Co., Atlanta
Stanbaugh, C. W., Demorest
Star Furniture Co., Athens
Toccoa Furniture Co., Toccoa
Trogdon Furniture Co., Toccoa
Union City Cabinet Works, Union City
Washington Mfg. Co., Washington
Winder Furniture Co., Winder
Womack, J. P. & Sons, Atlanta

HANDLES:
Atlanta Woodenware Co., Atlanta
Fowler Wainwright Hardware Co., Macon
Hanna Mfg. Co., Athens
Savannah Handle Co., Savannah
Standard Tool & Handle Co., Macon
Tifton Handle Mfg. Co., Tifton

LATH:
Barfield Lbr. Co., Vienna
Carolina Portland Cement Co., Atlanta
Daugherty McKey & Co., Valdosta
East Point Lbr. Co., East Point
Farrar Lbr. Co., Bainbridge
Kriegshaber, V. H. & Son, Atlanta
Pineora Mfg. Co., Pineora
Reynolds Bros. Lbr. Co., Albany
Williams, Homer, Thomasville
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
Zuber, John W., Atlanta

LOG CARTS:
Williams Mfg. Co., Macon

PLYWOOD:
Clark, R. C., Veneer Co., Atlanta
Southern Hardwood Lbr. Co., Waynesboro

PILES, POLES, POSTS:
Bacon, A. S. & Sons, Savannah
Chauncy, V. N., Jesup
Savannah Creosoting Co., Savannah
Seals, C. N., Kingsland
Southern Wood Preserving Co., Atlanta
Superior Pine Products Co., Fargo

REFRIGERATORS:
Warren, The Co., Atlanta
Wright, The, Co., Atlanta

SADDLE TREES:
Flor, Edward Co., Demorest

SASH, DOORS, BLINDS, MILL-WORK:
American Box & Lbr. Co., Macon
Americus Construction Co., Americus
Augusta Lbr. Co., Augusta
Bacon, A. S. & Sons, Savannah
Baxley Planing Mill, Baxley
Branch, Mrs. F. T., Quitman
Bright-Brooks Lbr. Co., Savannah
Bond & Waite Mfg. Co., Toccoa
Butler, John G., Savannah
Carter Lbr. & Mfg. Co., Columbus
Central Sash & Door Co., Macon
Cole, R. D. Mfg. Co., Newnan
Cooper Lbr. Co., Columbus
Cordele Sash, Door & Lbr. Co., Cordele
Crisp County Lbr. Co., Cordele
Carter Brothers, Rochelle
Case-Fowler Lbr. Co., Macon
Dawson Variety Works, Dawson
DeKalb Supply Co., Decatur
Campbell's Variety Works, Rockmart
Disbro Lbr. Co., Atlanta
Douglas Novelty Co., Douglas
Dublin Sash & Door Co., Dublin
Dudley Sash, Door & Lbr. Co., Columbus
East Point Lbr. Co., East Point
Farrar Lbr. Co., Dalton
Gresham Mfg. Co., Griffin
Harvey, W. T. Lbr. Co., Columbus
Jakin Novelty Works, Jakin
Lang's Variety Works, Sandersville
Lanier, J. W., Valdosta
LaGrange Lbr. & Supply Co., LaGrange
Marbut-Williams Lbr. Co., Atlanta
Marshall Mfg. Co., Rome
Meigs Variety Works, Meigs
Moss, R. L. Mfg. Co., Athens
New, D. F., Carrollton
O'Neill Box & Lbr. Co., Rome
Pattillo Lbr. Co., Atlanta
Perkins Mfg. Co., Atlanta
Phoenix Planing Mill Co., Atlanta
Randall Bros., Atlanta
Shore, F. M., & Co., Quitman
Thomasville Variety Works, Thomasville
Valdosta Builders Supply, Valdosta
Washington Mfg. Co., Washington
Willingham Sash & Door Co., Macon
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
W. S. Askew Co., Newnan
Williams, Homer, Thomasville

SHINGLES:
Archer, J. M., Sparta
Bacon, A. S. & Sons, Savannah
Baker & Co., Valdosta
Barfield Lbr. Co., Vienna
Chaucy, V. N., Jesup
Dougherty, McKey & Co., Valdosta
Downer Lbr. Co., Valdosta
Daniel, J. W., Franklin
East Point Lbr. Co., East Point
Farrar Lbr. Co., Bainbridge
Franklin, H. M. & Co., Tennille
Harrell, N. E., Pearson
McIntyre, Arch, Ousley
Mason Lbr. Co., Ochlochnee
Owens, A. J., Canon
Pierce, W. E., Edison
Pineora Mfg. Co., Pineora
Shiner, J. B., Poulan
Superior Pine Products, Fargo
Warnock, D. F., Tarrytown

SHINGLES—Continued
Wilder Lbr. Co., Tifton
Williams, Homer, Thomasville
Willingham-Tift Lbr. Co., Atlanta
Woodward Lbr. Co., Augusta
Zuber, Jno. W., Atlanta

SHOOKS:

Elberta Box Co., Bainbridge
Hightower Box & Tank Co., Atlanta
Jeffreys & McElrath Mfg. Co., Macon
O'Neill Lbr. & Box Mfg. Co., Rome
Pierpont Mfg. Co., Savannah
Union Box Mfg. Co., Atlanta

TANKS:

Hightower Box & Tank Co., Atlanta
Quitman Cooperage Co., Quitman

TRUCKS, TRUCK BODIES:

Columbus Truck & Supply Mfg. Co., Columbus
Fairbanks Co., Rome
Georgia Car & Locomotive Co., Atlanta
Miller, A. C. & Co., Atlanta
Williams Mfg. Co., Macon
Yancey Brothers, Atlanta

VENEER:

Augusta Veneer Co., Augusta
Brown, Robt. A., Raymond
Clark Veneer Co., R. C., Atlanta
Crown Mountain Veneer Co., Dahlonega
Dublin Veneer & Package Co., Brunswick
Georgia Veneer & Package Co., Brunswick
Glyck Veneer & Lbr. Co., Macon
Houston Mfg. Co., Perry
Lovelace-Brown Lbr. Co., Thomson
Midville Veneer Co., Midville
Reynolds Bros. Lbr. Co., Albany
Pierpont Mfg. Co., Savannah
Southern Crate & Veneer Co., Macon
Wadley Veneer & Basket Co., Wadley
Peerless Basket Co., Cuthbert

WAGONS:

Hancock Wagon Co., Culverton
Karwisch, J. M., Wagon Works, Atlanta
Sanders, John D., Waynesboro
Tarwood Mfg. & Supply Co., Dublin
White Hickory Wagon Mfg. Co., East Point
Williams Mfg. Co., Macon

WOODENWARE:

Atlanta Woodenware Co., Atlanta

SAW MILL OPERATORS OF GEORGIA

ACWORTH, Cobb County
Mills Lbr. Co. of Ga., Inc.

ADEL, Cook County
Adel Mfg. Co.

AILEY, Montgomery County
Thompson, H. V. & Bros.

ALAMO, Wheeler County
Adams, J. W.
Clark, W. M. & Co.

ALBANY, Dougherty County
Allen Brothers Lbr. Co.
General Lbr. Co.
Home Builders Lbr. & Supply Co.
Clancy Lbr. Co.
Reynolds Bros. Lbr. Co.

ALSTON, Montgomery County
Daniel, J. Fred & Sons
McArthur, J. J.
Sharpe, J. S.

AMERICUS, Sumter County
Lovelace, T. B., Lbr. Co.

AMSTERDAM, Decatur Conuty
Gragg Lbr. Co.

ARGYLE, Clinch County
Garrant Lbr. Co.

ASHBURN, Turner County
Carter, C. W.
Thrasher, C. E.

ATHENS, Clarke County
Athens Saw & Planing Mill

ATLANTA, Fulton County
Cleveland-Oconee Lbr. Co.

AUGUSTA, Richmond County
Augusta Hardwood Co.
Georgia Hardwood Lbr. Co.
Richmond Lbr. Co.
Woodward Lbr. Co.

BAINBRIDGE, Decatur County
Battle & Hodges
Carr, A. S. Co.

BANNING, Carroll County
Hanson, J. R.

BARNESVILLE, Lamar County
Barnesville Planing Mill Co.
Lavender & Brown
Milner Lbr. Co.

BARTOW, Jefferson County
Brown, T. S.
Hall, J. M.
Salter & Evans

BAXLEY, Appling County
Baxley Planing Mill
Miles, D. P.
Sellers, E. W.
Williams, N. F.

BLACKSHEAR, Pierce County
Johnson, A. M.
Woodall, C. C. Lbr. Co.

BLAKELY, Early County
Bailey, J. F. & Son
Hall, W. A. Lbr. Co.
Hunt, Washington & Hunt
Stuckey, Chas.

BLUFFTON, Clay County
Rambo, M.

BOSTON, Thomas County
Sherrod, J. H. & Sons

BROOKLET, Bulloch County
Altman, W. R. Lumber Co.
Howard, J. R.
Shearwood Lbr. Co.

BROOKLYN, Stewart County
Bell-Tate Lbr. Co.

BROOKS, Fayette County
Cooper Bros.
Lunsford, J. A.

BROXTON, Coffee County
Sapp, J. L.

BRUNSWICK, Glynn County
Brunswick Timber Co.
Haddock, Tomlinson Co.
Harrington, W. D.

BUCHANAN, Haralson County
Davis, W. E. & Son

BUENA VISTA, Marion County
Alexander & Burgin Lbr. Co.

BUTLER, Taylor County
Payne, W. A.

BYRON, Peach County
Cline, G. P.

CAIRO, Grady County
McCollom, P. J.
Thomas-Robinson Lbr. Co.

CALHOUN, Gordon County
Barton, H. C.
Calhoun Lbr. Co.
David, A. B.
Strain, J. A.

CAMILLA, Mitchell County
Goulden, B. H.
Manry, B. F.

CANON, Franklin County
Owens, A. J.

CARNESVILLE, Franklin County
Ginn Mfg. Co.

CARTERSVILLE, Bartow County
Shaw, L. F. & Sons Co.
Smith Lbr. Co.

CATAULA, Harris County
Alexander Bros. Lbr. Co.

CHARLES, Stewart County
Alexander & Bland Lbr. Co.

CHATSWORTH, Murray County
Cohutta Lumber Co.
Empire Talc & Lbr. Co.

CHIPLEY, Harris County
Chambers, J. M.
Champion, F. L.
Floyd, L. E.
Williams, John W.

CLARKESVILLE, Habersham County
Church, Geo.

CLAYTON, Rabun County
Bleckley, James E.
Mitchell, L. T.
Mozely, John

COLUMBUS, Muscogee County
H. Dixon Smith, Inc.

COGDELL, Clinch County
Timber Products Co.

COLQUITT, Miller County
Wilkin, P. E.

CONCORD, Pike County
Oxford, H. E.

CORDELE, Crisp County
Cordele Sash, Door & Lbr. Co.

COUNCIL, Clinch County
Council Lbr. Co.

COVINGTON, Newton County
Campbell Lbr. Co.

CRAWFORDVILLE, Taliaferro County
Flynt-Golucke Lbr. Co.

CUSSETA, Chattahoochee County
Burgin Lbr. Co.

CUTHBERT, Randolph County
King Lbr. Co.
Surles, R. E.

DACULA, Gwinnett County
Pharr, G. F.

DAHLONEGA, Lumpkin County
Hightower, W. J. & Son
Jarrad, J. C. & Bro.

DALLAS, Paulding County
Cochran, John L. Lbr. Co.
Phillips, John
Willis, D. F.

DALTON, Whitfield County
Brooker Lumber Co.
Strain, E. E.

DAMASCUS, Early County
Rose-Mary Lbr. Co.

DANIELSVILLE, Madison County
Barrett, E. B.
Rogers, B. F.

DANVILLE, Twiggs County
Danville Lbr. Co.

DARIEN, McIntosh County
Altamaha Lbr. Co.

DAVISBORO, Washington County
Warthen, W. B.

DAWSON, Terrell County
Rowland, D. H. Lbr. Mills
Shields & Geise Lbr. Co.

DECATUR, DeKalb County
Hierston, W. T.
Ozmar, J. H.

DESOTO, Sumter County
Moore Lbr. Co.

DEVEREAUX, Hancock County
Grooms, M. M. Lbr. Co.

DOLES, Worth County
Champion, J. C.

DOUGLAS, Coffee County
Pat Darby Lbr. Co., Inc

DUBLIN, Laurens County
Dublin Sash & Door Co.
Gettys, J. M. Lbr. Co.

EASTMAN, Dodge County
Dodge County Lbr. Co.

EATONTON, Putnam County
Carpenter Lbr. Co.

EDISON, Calhoun County
Pierce, W. E.
Turman Lbr. Co.

EGYPT, Effingham County
Roundtree, W. P.
Standard Lbr. Co.

ELLAVILLE, Schley County
Alexander, A. C. Lbr. Co.
Drew, J. A.
Hart, H. A.
Smith Bros.
Tidd Bros.
Wald, W. A.
Smith & Wall

ELLERSLIE, Harris County
Alexander Bros. Lbr. Co.

ELLIJAY, Gilmer County
Henson Bros. & Barnes
Shippen Hardwood Lbr. Co.

ETON, Murray County
Lefurgey, J. J.

FACEVILLE, Decatur County
Hancock Lbr. Co.

FAIRMOUNT, Gordon County
Fairmount Lbr. Co.
Lowe, J. I.

FARGO, Clinch County
Superior Pine Products Co.

FAYETTEVILLE, Fayette County
Blalock Lbr. Co.
Cox, W. F.
Graves, Ernest
Redwine Bros.

FOLKSTON, Charlton County
Gowen, A. G.
Johnson, J. H.

FORSYTH, Monroe County
Hardin Lbr. Co.

FORTSON, Muscogee County
Fortson Lbr. Co.
Franklin & Carey Lbr. Co.

FRANKLIN, Heard County
Daniel, J. W.
Johnson & Hammond
Norwood, J. E.
Spradling, J. W. & Sons

GAINESVILLE, Hall County
Hammond, V. L.
North Georgia Lbr. Co.

GARDNERS, Washington County
Cleveland-Oconee Lbr. Co.

GIBSON, Glascock County
Bowden-Hooks Lbr. Co.

GIRARD, Burke County
Mobley Bros.

GLENNVILLE, Tattnall County
Burns, T. F.
Phillips, L. & Bros.
Tootle, G. W.

KITE, Johnson County
Meeks, W. B.

LAFAYETTE, Walker County
Clements & Quillian
Mize, R. F. & Son
Ponder, J. R.
Rea, J. H. B.

LAGRANGE, Troup County
Askew, W. S. Co.

LAKE PARK, Lowndes County
Ivers, C. H. & Son
Watts & Co.

LAWRENCEVILLE, Gwinnett County
Jackson, C. M.
Jackson, C. P.

LEARY, Calhoun County
Tyson & Stubbs

LILLY, Dooly County
Cox, J. E.
McCormick, D. A.

LINCOLNTON, Lincoln County
Bunch & Harnesberger
Lincoln Lbr. Co.
Wilkinson, J. G.

LIZELLA, Bibb County
Carswell, M. C.
Marshall, C. E.
Marshall, W. J.
Van Valkenburg, A. B.
Whittle & Fackler

LITHONIA, DeKalb County
Johnson, J. C.'s Sons

LOCO, Lincoln County
Taylor, Clyde H.

LOGANVILLE, Walton County
Cooper, M. E.

LOUISVILLE, Jefferson County
Jones, S. E.
Kelly, T. B. Lbr. Co.

LOVEJOY STATION, Clayton County
Dickson, J. S.

LUDOWICI, Long County
Bladen Tie & Lbr. Co.
Jones, C. D.

LUMBER CITY, Telfair County
Rush, J. H.

LUMPKIN, Stewart County
Alexander & Bland Lbr. Co.
Lawson, W. R. & Bro.

GLENWOOD, Wheeler County
Browning, J. M.
Pearson Hardwood Flooring Co.
Rivers & Jones

GRAHAM, Appling County
Ham, W. B.

GRANTVILLE, Coweta County
Grantville Oil Mill

GROVETOWN, Columbia County
Dorn, R. B.

HAMILTON, Harris County
Pine Mountain Lbr. Co.

HAPEVILLE, Fulton County
Evans-Inman Lbr. Co.

HARLEM, Columbia County
Harlem Mfg. Co.

HARTWELL, Hart County
Cobb, J. A., Saw Mill Co.

HATCHER, Quitman County
Bland, D. G. Lbr. Co.

HAWKINSVILLE, Pulaski County
Grand Bay Lbr. Co.
Hawkinsville Lbr. & Mfg. Co.
Lick Creek Lbr. Co.
Warren & DuPre

HELEN, White County
Morse Bros. Lbr. Co.

HILLSBORO, Jasper County
White Lbr. Co.

HOBOKEN, Brantley County
Newton & Jones

JACKSONVILLE, Telfair County
Williams, M. & C. W.

JERSEY, Walton County
Harris, J. T.
Wiley, B. A.

JESUP, Wayne County
Chauncy, V. N.
Garbutt Lbr. Co.

JONESBORO, Clayton County
Berry Bros.

JULIA, Stewart County
Union Lbr. Co.

JUNCTION CITY, Talbot County
Callier, N. V.

JUNIPER, Marion County
Rogers, A. N.

MORVEN, Brooks County
Elliott Lumber Co.

MOULTRIE, Colquitt County
Ladson Lbr. Co.
Morris Brothers

MT. VERNON, Montgomery County
Johnson, W. A.

NEWNAN, Coweta County
R. D. Cole Mfg. Co.

NORCROSS, Gwinnett County
Flowers, W. D.
Gastley, C. E.
Green, J. C.
Litsch, W. R.

OAKFIELD, Worth County
Nation, J. A.

OCHLOCHNEE, Thomas County
Mason Lumber Co.

OCILLA, Irwin County
Willis Lbr. Co.

OCONEE, Washington County
Ennes, E. N.
Hodges, C. M. & Sons

ODESSADALE, Meriwether County
Glanton, W. A.

ODUM, Wayne County
Brentwood Lbr. Co.
Thompson Bros.
Warren, R. E.

OFFERMAN, Pierce County
Thomas, R. J.

OGEECHEE, Screven County
Fetty, I. H.

OGLETHORPE, Macon County
Cobb Lbr. Co.
Flint Lbr. Co.

OLIVER, Screven County
Barber, W. W.
Colson, J. L. & Son

OXFORD, Newton County
Dial, C. B.

PELHAM, Mitchell County
Whaley, A.

PEMBROKE, Bryan County
Bowen, L. S.
Parrish, W. W.

PINEORA, Effingham County
Pineora Mfg. Co.

LUXOMNI, Gwinnett County
Hannah, A. S.
Pearson, J. H.

McINTYRE, Wilkinson County
Hall, J. M. Lbr. Co.

McRAE, Telfair County
Krumrine, J. H. C.

MACON, Bibb County
Case-Fowler Lbr. Co.
Chambers Lbr. Co.
Davis-Richardson Lbr. Co.
Georgia Hardwood Co.
James & Kingman Lbr. Co.
Massee & Felton Lbr. Co.
Richardson Lbr. Co.
Wainwright-Young Lbr. Co.

MADISON, Morgan County
Atkinson, W. W.
Mallory, T. A.
Mason Lbr. Co.

MANASSAS, Tattnall County
Holland, John L.

MARSHALLVILLE, Macon County
Goodwin, S. B.

MATTHEWS, Jefferson County
Gay, W. S.
Pennington, A. F.

MAYSVILLE, Banks County
Bacon Milling Co.

METASVILLE, Wilkes County
Lovelace, T. B. Lbr. Co.

METTER, Candler County
Brannen, I. A. & J. L.

MIDVILLE, Burke County
Fry, L. B. Lbr. Co.
Higdon Lbr. Co.
Wray-Joyner Co.

MILLEDGEVILLE, Baldwin County
Bland Lbr. Co.
Central Georgia Lbr. Co.
Crooms, M. M.

MILLEN, Jenkins County
Aaron, T. W.
Millen Lbr. Co.
Turner Lbr. Co.

MILNER, Lamar County
Chappel, A. H.

MONROE, Walton County
Monroe Lbr. Co.

MONTICELLO, Jasper County
Walker, J. N.

POWDER SPRINGS, Cobb County
Baynton, R. A.
Florence, W. L.
Smith, J. F.

PRESTON, Webster County
Cagle, W. W.
Montgomery, G. A.
Patterson & Davis
Rees, J. O. & Sons
Sappington A. Averett

QUITMAN, Brooks County
Shore, F. M. & Co.
South Georgia Lbr. Co.

RANGER, Gordon County
Earnest, G. C.

RESACA, Gordon County
Resaca Lbr. Co.

REYNOLDS, Taylor County
Saunders & Sealey

RICHLAND, Stewart County
Alexander & Bland
Bell Lbr. Co.
Dudley Lbr. Co.

RINGGOLD, Catoosa County
Catoosa Lbr. Co.
Clark, J. H.
Combs, C. M.
Creswell, W. O.
Embesson, T. S.
Hulsey & Combs
Vosburg, C. C.

ROBERTA, Crawford County
Starnes, W. C.

ROCKMART, Polk County
Davenport Bros.
Ezell, J. C.

ROSWELL, Cobb County
Maxwell, J. T.

ST. MARYS, Camden County
Lang, Walter

SANDERSVILLE, Washington County
Harrison, T. I.
Red Bird Lbr. Co.
Rough Diamond Lbr. Co.

SAVANNAH, Chatham County
Forester-Cunningham Lbr. Co.
Godley-Green Lbr. Co.
Liberty Lbr. Co.
Mead & Manucy
Reynolds & Manley Co.
Savannah River Lbr. Co.
Smith, W. W. Lbr. Co.
Southern Lbr. Co.
Stovall, W. I.

SCOTLAND, Telfair County
Wilks Brothers

SENOIA, Coweta County
Nations, T. D.

SHARON, Taliaferro County
Flynt & Moore

SHELLMAN, Randolph County
Church-Robinett Lbr. Co.

SILOAM, Green County
Boswell, E. T., Co.

SMITHVILLE, Lee County
Fite, J. B.
Lee County Lbr. Co.

SOPERTON, Trutlen County
Fowler, James

SPARKS, Cook County
Stutts & Daugherty

SPARTA, Hancock County
Archer, J. M.
Ethridge Lbr. Co.

STATESBORO, Bulloch County
Howard, Arthur

STEVENS POTTERY, Baldwin County
Weaver, W. T.

STILSON, Bulloch County
Brown-Bland Lbr. Co.
Zickgraf Lbr. Co.

SUMMERVILLE, Chattooga County
Edwards, Daniel

SUWANEE, Gwinnett County
Jones, Gus

SWAINSBORO, Emanuel County
Lamb, T. D.
Swainsboro Lbr. Co.

SYLVANIA, Screven County
Brantley, W. L.
Mallory Bros.
Perkins, M. & H.
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White, J. C.

SYLVESTER, Worth County
Simmerly & Lawrence

TALBOTTON, Talbot County
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Southmont Mfg. Co.

TALKING ROCK, Pickens County
Talking Rock Mfg. Co.

THOMASTON, Upson County
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Perkins, J. T.

THOMASVILLE, Thomas County
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Houston Lbr. & Tie Co.
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Turner, J. L. Co.
Upchurch, W. J.
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Bowden, Paul A.
Bowden-Kunnes Lbr. Co.
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Coarsey Lbr. Co.
Postell Lbr. Co.

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Savannah Valley Lbr. Co.
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Lord, J. T., Jr.
Lovelace-Eubanks Lbr. Co.

TRENTON, Dade County
Morrison & Pace

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McArthur, J. J.

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Bray, J. N., Lbr. Co.
Downer Lbr. Co.
Jackson Bros., Lbr. Co.

VILLA RICA, Carroll County
Henslee, A.
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WADLEY, Jefferson County
Middle Georgia Lbr. Co.
Warm Springs Planing Mill

WARRENTON, Warren County
Bostonville Planing Mill Co.
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Warsaw Lbr. Co.

WARTHEN, Washington County
Rachel, A. P. & Bro.
Warthen Lbr. Co.

WARWICK, Worth County
Whitfield, L. C.

WASHINGTON, Wilkes County
Mauney, Frank L.
Pope Lbr. Co.
Scott-Strother Lbr. Co.
Washington Mfg. Co.

WAVERLY HALL, Harris County
Waverly Hall Lbr. Co.

WAYNESBORO, Burke County
Claxton, R. L.
Green Bros.
Waynesboro Planing Mill

WAYSIDE, Jones County
Wood, J. D.

WEST POINT, Troup County
Batson-Cook Co.

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Weston Lbr. Co.

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Starr, J. W., & Sons

WHITE PLAINS, Green County
Taylor Bros.

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Edgeworth, W. F.

WILLACOOCHEE, Atkinson County
Doster & Ladson

WINDER, Barrow County
Jones, W. J.
Millsaps, G. S.

WOODSTOCK, Cherokee County
Poor, A. F.

WOODVILLE, Green County
Moody, C. G.

WRENS, Jefferson County
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Wren, R. A.

WRIGHTSVILLE, Johnson County
Jackson, M. A.
Keel Lbr. Co.
Lovett, W. H., Lbr. Co.
Rowland, R. H.
Smith, R. H.
Sumner, E. J.

YATESVILLE, Upson County
Brown, W. M.

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Home Builders Supply Co.
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Brunswick Peninsula Co.
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Jones Mercantile Co.

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Dudley Sash & Door Co.
Harvey Lbr. Co.
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COMER
Gholseton Bros.

COMMERCE
Commerce Brick & Lbr. Co.

CONYERS
W. R. Still

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Cordele Sash & Door Co.
Crisp Lbr. Co.

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Cornelia Hardware Co.
Gallaway & Hopper
Holbrook Hardware Co.

COVINGTON
S. H. Adams

CRAWFORDVILLE
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CUTHBERT
Cuthbert Coal & Wood Co.

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Dallas Milling Co.
Lee Hardware Co.

DALTON
Acme Lbr. Co.
Cherokee Mfg. Co.
Farrar Lbr. Co.

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Dawson Variety Works
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Shields-Geise Lbr. Co.

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Pat Darby Lbr. Co.

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Dublin Sash & Door Co.
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I. M. Suddeth

EASTMAN
Nicholson Lbr. Co.

EAST POINT
East Point Lbr. Co.

EATONTON
C. M. Hudson

EDISON
W. E. Pierce

ELBERTON
Herndon & Smith

ELLA GAP
Davis Brothers

EASTPORT
Brooks-Scanlon Corporation

FAIRBURN
Johnson & Co.

FARMINGTON
H. T. Murrow

FAYETTEVILLE
Redwine Brothers

FITZGERALD
Standard Supply Co.

FORSYTH
Forsyth Coal & Lbr. Co.
Webb Lbr. Co.

FORT GAINES
Kellingsworth Hardware Co.
Ross Hardware Co.
Georgia Basket & Lbr. Co.

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C. M. Chambers

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GEORGETOWN
Pine Lbr. Co.

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Grantville Lbr. Co.

GREENSBORO
McCommons-Thompson Boswell Co.

GREENVILLE
Builders Supply Co.

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Gresham Mfg. Co.
Griffin Lbr. Co.
Newton Coal & Lbr. Co.
Robt. Wheaton & Sons

HAMPTON
Henderson Coal & Lbr. Co.

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W. D. McEachern

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H. T. Gilmore
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LAFAYETTE
Chas. Clemons
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LaFayette Coal & Wholesale Co.
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LAGRANGE
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LaGrange Lbr. & Supply Co.

LAVONIA
Harbin Bros.
L. O. Mauldin

LAWRENCEVILLE
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LILLY
Ricks Lbr. Co.

LITHIA SPRINGS
P. H. Winn

LITHONIA
A. J. Almand & Co.

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R. H. & M. M. Brown
A. G. Combs

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Bibb Lbr. Co.
Builders Lbr. Co.
T. C. Burke, Inc.
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Central City Lbr. Co.
Central Sash & Door Co.
Chambers Lbr. Co.
E. J. Hancock
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Macon Supply Co.
J. W. McCook Lbr. Co.
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The Ross Co.
Willingham Sash & Door Co.

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Farmers Hardware Co.

MANCHESTER
J. P. Corley Lbr. Co.

MANSFIELD
Mansfield Lbr. Co.

MARIETTA
Black Builders Supply Co.
McNeel Lbr. Co.
Stephens Lbr. Co.

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A. T. Brightwell & Sons

McDONOUGH
Berry Lbr. Co.
Carmichael Lbr. & Coal Co.
Planters Warehouse & Lbr. Co.

METTER
Metter Lbr. Co.

MIDVILLE
M. D. Jones

MILLEDGEVILLE
Bland Lbr. Co.
Fowler-Flemister, Inc.

MILLEN
Builders Supply Co.

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MONROE
Langston Lbr. Co.
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R. L. Marsh
Builders Supply Co.

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Cureton-Cole Co.

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Whaley Bros.

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Perry Warehouse Co.

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South Georgia Lbr. Co.

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G. C. Earnest

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J. H. Clark

ROCKMART
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SPARTA
Sparta Lbr. Co.

STATHAM
J .S. Holliday

STOCKBRIDGE
J. W. Patillo

SWAINSBORO
J. R. Coleman
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THOMASVILLE
W. E. Beverly
L. F. Driver & Co.
Kirby Planing Mill
Thomasville Variety Works

THOMSON
Knox Hatcher Lbr. Co.
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TOCCOA
Ramsey-Martin Hardware Co.

UNION CITY
Union City Lbr. Co.

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Stewart & Ruthford

VALDOSTA
The J. N. Bray Co.
Briggs Hardware Co.
Eva Lbr. Co.
Ga. Fla. Lbr. Co.
Georgia Lbr. & Supply Co.
Jackson Bros.
Larsen & Forbes Hardware Co.
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Nicholson & Ward

WAVERLY HALL
Pitts Lbr. Co.

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Enterprise Mfg. Co.

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Builders Supply Co.
Neely Builders Supply Co.

WEST POINT
West Point Coal & Lbr. Co.
West Point Iron Works

WINDER
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Tidwell Lbr. Co.

MAY, 1929 *Bulletin 6*

Georgia Forest Service

B. M. LUFBURROW, *State Forester*

Georgia Forest-Parks

By

C. A. WHITTLE, *Director of Education*
BONNELL H. STONE, *Secretary Georgia Forestry Association*

Georgia Forest-Parks

C. A. Whittle
Director of Education

A series of forest-parks in easy reach of centers of Georgia's population is a goal that forestry leaders have set up. Already two state forest-parks have been established, the Vogel State Forest-Park at Neel Gap on Blood Mountain, Union County, in North Georgia, and Indian Springs, Butts County in Middle Georgia.

The purpose of a state forest-park is to teach a greater knowledge, keener appreciation and better usage of the State's greatest natural resource—the forests. A lack of public realization of the necessity for forest protection is resulting in an annual loss to this State of millions of dollars. This handicap can not be overcome until the public is shown how to protect the forests. An object lesson is a convincing lesson. Hence, the importance of establishing state forest-parks. Where the State acts the people take notice.

A state forest-park stands as a physical declaration by a commonwealth on a matter of great public importance—the promotion of the wealth producing power of the forests; it is an object lesson telling its message so plainly that anyone who runs may read; it is a demonstration showing how to protect, develop and utilize forest growth; it is one important method of making the public "forest minded" and ready to react favorably to every forward looking forestry movement—the welfare of the State requiring it.

The forests will come back. They only want a fair chance. Shall they get it?

Between the crest of the Blue Ridge Mountains and the tide waters of the Atlantic Ocean, Georgia has 163 species of trees

—an extraordinary variety. Georgia's pines and hardwoods have poured forth a never-ceasing stream of wealth since the days of the first settlers, a stream of wealth that in later years has been dwindling. Had good forest management been practiced all this while this stream of wealth would have been flowing steadily on with volume well maintained.

Europe learned long ago the value of the forest-park. For three hundred years some of the town-owned forests have been

View of Blood Mountain, at Vogel Forest-Park

managed so as to yield an annual crop of timber, the revenue from which has in some instances not only paid the running expenses of the towns but has brought dividends to its citizens. Think of receiving public funds instead of paying out taxes! The experiences of these European towns would indi-

cate that a series of state forest-parks of proper size in Georgia may also eventually become a source of profit—a revenue-producing asset for Georgia.

In general, the plan of the Georgia system of state forest-parks is to have an area sufficiently large for each forest to provide a recreation center or park area and also an area for demonstrating reforesting, thinning, harvesting, fire control and all that goes with right forest management.

Beautiful waterfall at Vogel Forest-Park

VOGEL FOREST-PARK

At present the two state forest-parks are devoted largely to recreational purposes, for which both are particularly adapted. During the summer and fall of 1928, more than 14,000 people registered at the Neel Gap Ranger Station of Vogel

Forest-Park, with ten foreign countries and forty-two states of the Union represented.

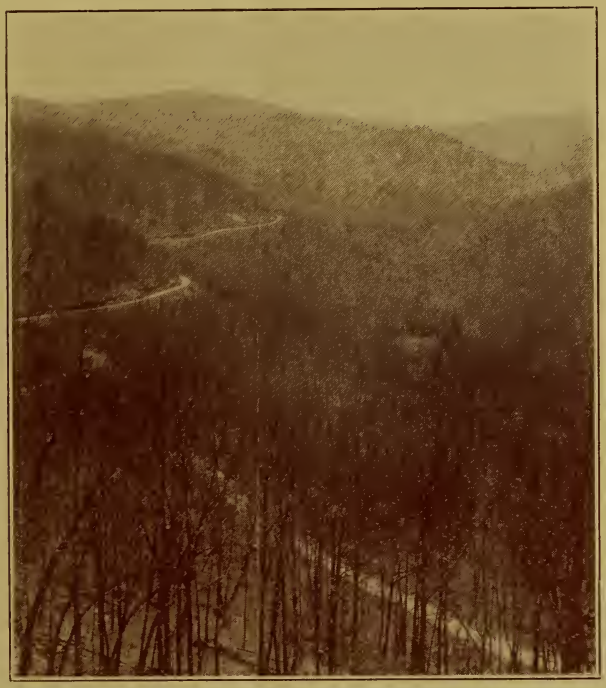
This forest-park at present includes 160 acres, a gift to the State of Georgia by a patriotic citizen of Wisconsin, and is situated on Blood Mountain at an elevation of about 3,000 feet. Through this park runs the Neel Gap Highway, a popular scenic highway penetrating one of the most picturesque areas of the

Scenic approach to Vogel Park—Hard surfaced road

Southern Appalachians, and providing a convenient route for north and south travel.

At the highest point on this highway the Georgia Forest Service maintains ranger's quarters with provisions for the accommodation of visitors, including lunches and cold drinks.

A beautiful waterfall 100 feet high is in the immediate vicinity of these headquarters. Leading up from the camp an easy trail two miles long, reaches the crest of Blood Mountain. Here a magnificent panorama greets the eye at every point of the compass. To the north are the purple and sapphire mountains extending range after range, broken here and there by fertile, peaceful valleys, the glint of rivers and wind-



Winding highway approaching Vogel Forest-Park

ing highways. To the east and west the eye is greeted by forest-clad mountains tumbled in an irregular but picturesque panorama. To the south the mountains break into a wide sweep of the Piedmont plateau.

On Blood Mountain a stone tower is to be erected as a memorial to Georgia's world-war soldiers, and dedicated as the

American Legion Memorial Tower. This tower is not only to stand as a perpetual memorial to heroism, but will serve as a watch tower for forest rangers and as a lookout for visitors. Thus, historic interest will be added to the natural and scenic value of Vogel Forest-Park.

INDIAN SPRINGS FOREST-PARK

In the central part of Georgia, nestling in the rolling, forested hills of the Piedmont plateau, is the historic Indian Springs, famed for its health-giving waters, its historic associations and its Indian lore. To this resort flock thousands each year, not only from Georgia, but from many other states, seeking health and recreation. Four hotels provide the chief accommodations for visitors. A beautiful town adjoins the property. Hard surfaced and other excellent highways center there.

The Georgia Forest Service was commissioned in 1927 by the State to take over and operate this property as a state forest-park, the area having been the property of the State since the signing of the Indian Treaty of 1802. The condition of the property was poor as the result of neglect. Much needed to be

Automobile Parties at Vogel Forest-Park

Vistas and Waterfalls in Vogel Forest-Park

done to put the buildings and grounds in presentable shape. The funds available were too small, but with other funds made available from private sources, gratifying progress has been made in repairing, in new construction and in beautifying the property.

Campers at Vogel Forest-Park

Much credit is due to the local woman's club through the initiative of which funds have been raised and improvements carried on far beyond what otherwise could have been accomplished. In time and with adequate funds the Indian Springs Forest-Park will become more and more a recreational center of which the state will be proud.

It is the hope that the present holdings of the state will be enlarged so that the Indian Springs Forest-Park will have greater area for demonstrating the recreational and practical value of forest lands.

Ranger's Quarters at Vogel Forest-Park

GENERAL INTEREST IN FOREST-PARKS GROWS

The interest in state forest-parks in the United States is growing. In the last three years 1,820,939 acres have been added, making the total area in state forests and state and town forest-parks 12,136,945 acres. The states acquiring forest areas for the first time since 1925 were Georgia, Delaware and South Carolina. The greatest extension in state forest areas during the period was the state of Washington which added 1,200,000 acres. Pennsylvania added 167,788 acres and Michigan 167,-

000 acres. Massachusetts leads in the number of town forests, having 80 out of 100 town forests in this country.

In Europe town forests are numerous. In France 11,000 out of 35,000 towns or communities own forests, totaling approximately 5,000,000 acres. In Germany there are 1,500

One of Vogel-Park waterfalls

town-owned forests, 500 of which are reported to pay not only all local expenses but return a surplus as a bonus to citizens.

AN AUTHORITY'S VIEWS ON GEORGIA'S FOREST-PARKS

Honorable Bonnell H. Stone, a trained and practicing forester, residing at Blairsville, Ga., has been designated the "Father of Forestry in Georgia." Through his enthusiastic, able and aggressive leadership and with the aid of forward-looking

Tourist at Vogel-Forest Park viewing the mountain scenery

citizens of the state, the Georgia Forestry Association was formed. As a result of the activities of this organization, the Georgia Forest Service came into existence with its trained state forester and his staff, now functioning in promoting forestry in the state.

Vogel Forest-Park Quarters, where meals are served

Mr. Stone is a great believer in the state forest-park as a factor in developing public sentiment necessary to the success of carrying out a program for the development of the state's forest resources. It was largely through his instrumentality that Vogel State Forest-Park and Indian Springs Forest-Park have been acquired by the Georgia Forest Service. His hopes and expectations are that before many years Georgia will have a

View of Pavilion and Bath House at Indian Springs

series of forest-parks distributed advantageously over the state, teaching by example how to restore and maintain the great wealth producing power of Georgia's forest lands.

It is highly appropriate in this connection to reproduce some of the statements which Mr. Stone has made on the subject of forest-parks:

"To the people of Georgia—especially those who are un-

able to afford vacation trips to distant points—a system of State Forest-Parks would offer at once a remarkable variety of free public recreation grounds and a wonderful group of demonstration areas for teaching the economic value of forests and forestry.

"We may all agree that public ownership of forest lands might prove a hinderance to private industry, if it were prob-

Healing waters flow from the hill—the spring is at the marquet on the left

able that such a policy could ever place a large enough percentage of the forests under the control of federal, state, county and municipal governments. But the possible control of timber lands, by all public agencies combined, could perhaps never produce timber supplies in sufficient quantity to meet more than a limited part of the demands of our great Nation. All forestry experts are agreed that the greater part of our forest products in America must always be produced on privately

owned forest lands. The only excuse for economic forestry is to produce lumber and other forest products for the proper use of our people. Therefore, one of the greatest values in public ownership of forest lands is derived from demonstrational uses which should prove profitable examples for the practice of private forestry.

Summer visitors at Indian Springs

GEORGIA'S GREAT VARIETY OF TREES

"With the one exception of Florida, the State of Georgia has within its borders more different kinds of trees than any other State in the Union. We are beginning to have new visions of the values in young tree growth and the rapid reproduction of the many tree species in the State. Famed for her soils and climate, Georgia should demonstrate to the world that natural resources will be the foundations of future fortunes for

home seekers of the most desirable sort. Profitable farm lands, interspersed with shelter-belts of profitable forests, would present a picture in Georgia's oldest agricultural sections which would be in great contrast to the present conditions in some of our counties where abandoned farms and waste lands are an eye-sore. Vast areas of young forests and natural repro-

Stream and Mill Dam alongside the park at Indian Springs

duction, under proper methods of administration and protection, would present another picture in striking contrast to much of our cut-over pine lands of today.

A CHAIN OF STATE FOREST PARKS

"Georgia has adopted a State Policy of forestry. Then why not establish a system of State Forest Preserves which would embrace the essential features of profitable forestry and of out-

door recreation, under proper supervision and instruction in forestry, wood-craft and camp-craft?

"To encourage our people to live in the woods, even for a short time each year, will mean that a greater love for the woods will engender a desire for better forest protection. Cer-

View from the Eagle Nest Lookout at Indian Springs

tainly the pride of State ownership in numerous tracts of timber lands, in desirable locations throughout Georgia, would create greater interest and public sentiment for better forest management. Many people may never avail themselves of the joys or experiences of an overnight camp, but all picnickers and campers would appreciate the convenient location and the modern comforts of forest-parks and camp-sites provided on a State

Forest Preserve. Each forest preserve would have its public accommodations, such as parking spaces, barbecue pits and tables, toilets, and perhaps some overnight cabins, as near the roads and entrance as possible, thus including the features of a forest-park and at the same time preserve the most scenic areas

Swimming Pool at Indian Springs

and beauty spots for hikers, students of wild life and nature lovers; where the campers who provide their own tents may find seclusion, and where some of the forests can be kept in a state resembling their original condition. Each acre of a forest preserve should be developed for its best use. The convenience and pleasure of the public would be largely met on the area designated as the forest-park, thereby keeping the inner solitudes of the forest preserve comparatively undisturbed for encouraging the increase of plant, animal and bird life.

GEORGIA'S PROGRESS IN FORESTRY

"Georgia has made rapid progress in forestry, under the Legislative Act of 1925. The Georgia Forest Service is charged with the enforcement of the forest fire laws of the

A fountain of Wisteria in bloom at Indian Springs

State, but our 22,000,000 acres of privately owned forest lands cannot receive the adequate protection necessary until the thousands of land owners are aroused to their need of co-operative protection, and until the general public gives whole-hearted support to the slogan—*"Grow, Protect, Use Georgia Timber."* The Georgia Forestry Act also provides for the establishment of State Forests, through the acquisition of land by gift, or by purchase when the Legislature may provide the necessary funds. The State needs a system of forest preserves, from the moun-

tains to the sea. Our larger cities should have thousands of acres of forests, for both recreational and economic uses, and every town of five thousand inhabitants or more should have at least a small forest preserve near it. *Out-door recreation is most desirable on publicly owned lands, and State Forests will also encourage a more general protection of all forest lands, but we cannot expect to see private forestry and public recreation work very well together.*

VALUABLE INVESTMENT

"The State should own at least ten forest preserves containing from 1,000 to 10,000 acres each, or 20 forest preserves with a total of 500,000 acres. With sufficient area in each State Forest-Park for adequate and economic administration, and with a proper distribution of these administrative units, Georgia would have an ideal system of free public recreation grounds within easy reach of all her citizens. On the whole, the sale of forest products should more than pay maintenance and protection costs from the beginning, and would soon provide necessary funds for improvements and development work. The big profits in good citizenship and demonstrational values would not be collected by any one generation, but Georgia would grow in greatness from every standpoint as the result of such a practical and far-reaching investment."

Endorsement of Governors Hardman and Roosevelt

It is with gratification that there can be included in this bulletin a few words from Hon. L. G. Hardman, Governor of Georgia, and the distinguished part-time resident of Georgia, Governor Franklin Roosevelt of Albany, New York, and Warm Springs, Georgia, in endorsement of the State Forest-Parks. These statements have been made in communications to the State Forester.

GOVERNOR HARDMAN'S APPROVAL

"Reforestation, conservation and proper utilization are important to the development of forest wealth in Georgia. Forests have been and should continue to be one of the state's greatest natural resources. We are facing a decline in the output of our forests, a much greater decline than would have been had the people of Georgia protected their forests from fire and allowed nature to bring on a second crop.

"Our Georgia Forest Service, organized only three years ago, is making progress in arousing the State to a greater appreciation of the value of its forests and how to develop their opportunities; it is organizing timber owners for fire protection and is carrying on an effective educational campaign.

"One of the methods being employed is the Forest-Park. This seems to be an effective way of arousing the public to an appreciation of the forests and is in line with the action of other states and other countries. Donations of forest land by public spirited citizens for use as state forest-parks where demonstrations in proper forest management may be practiced and recreational areas may be set aside for public enjoyment, are very desirable.

"It is with pleasure that I endorse this forward movement looking to the upbuilding of the state's forest resources.

"L. G. HARDMAN."

GOVERNOR ROOSEVELT APPROVES FOREST-PARKS

"It is very heartening to know that Georgia is seriously taking up the great problem of reforestation and of state parks. The two go hand in hand.

"I hope to see the day when capital will realize the value of investing in new timber growth for this is a crop in which there is little risk, even though the return on the investment has to be delayed for a number of years.

"The State can well afford, through the creation of State Forest-Parks and demonstration areas, to prove the value of forestry to the average citizen. As in most of the other older states, a large part of land now devoted to annual crops could better be employed in growing trees. This is a vital necessity for the future generations of Georgia citizens.

"FRANKLIN D. ROOSEVELT,
"Governor of New York."

"Warm Springs, Ga.
"May, 1929."

April, 1929 Bul. 7

Georgia Forest Service

B. M. LUFBURROW, *State Forester*

Vocational Forestry

By

CHARLES A. WHITTLE,
Director of Education and Utilization

INTRODUCTION

This publication has been prepared with a view to presenting basic facts about forestry, and to suggest observations and demonstrations in connection with school forests. References are made to other publications for supplementary use.

The vocational schools of Georgia are the first in this country to take up forestry with a demonstration school forest. Each school conducting the project has one or more tracts which the students will handle under the direction of the Agricultural Vocational teacher, in line with working plans developed by the State Forest Service. Representatives of the State Forest Service will visit the school forests once or twice a year.

Students demonstrating outstanding qualifications as shown by school work will be awarded scholarships to summer forestry camps, where more advanced and practical work in forestry will be given leading to a certificate of Vocational Forester, which will recommend the holder for one or more of the positions of forest ranger, fire warden, timber cruiser, log and lumber inspector, superintendent of saw mills, manager of turpentine operations, superintendent of state forest-parks and other non-technical forestry jobs.

PART I

How Trees Grow

Seed. Most trees produce abundant seed, more, in fact, than is ever needed to keep up forest growth. But so many things can happen to seed. Birds and animals of various kinds feed on tree seed; many fall in places where there is no chance for them to grow; some fall and start growth but other trees have the advantage and suppress them; quite a few do not have the power to germinate; fires often come to destroy them; and competition among trees for ground space in the forest is keen. So it is that abundant seed are essential for a tree species to survive all the adversities of its environment and hold its place in the forest.

Seed Distribution. Tree seed assume many forms. Pines produce them in cones and equip each with a wing so that it can fly on the wind as far as a quarter of a mile and sometimes further. Many other species of trees are similarly equipped for wind distribution.

An acorn or nut has no facilities for traveling. It falls straight to the ground. Squirrels are its chief distributors through their instinct for carrying nuts and storing them in the ground for future food supply, then, either forgetting where nuts are buried or finding it unnecessary to use them as food, the squirrel leaves them to germinate and start growth where the nut-bearing tree could not scatter them.

Germination. Every well-developed, mature tree and seed contains a germ. When the temperature is warm enough and moisture is present, the seed germ starts growth. This is called germination.

In each seed is stored enough plant food to promote growth until the roots are formed to draw on the supply of plant

food in the ground and until a green shoot is sent up to get sunlight and what it needs from the air. As soon as roots and leaves have developed a distinct plant is formed called a seedling.

Roots of Trees. The seedling at once begins the development of a root system. The roots serve as an anchor to hold the tree upright, a matter of great importance when the height of trees and the strain on them by high winds are considered. Tall, slender trees like pine have long, strong tap roots to brace them against winds.

While tap roots absorb some moisture and plant food, the main feeding roots are the lateral or spreading roots that range near the surface where plant food is more abundant. These lateral roots have many branches on which are many very small tender roots that absorb soil water and take in plant food that is carried up into the tree to supply growth material.

Tree Leaves. The function of the leaves of trees is to absorb sunlight and to take a gas called carbon dioxide out of the air. The sunlight falling on the leaf and carbon dioxide entering the leaf through minute openings called stomata account mainly for the production of starch in the green surface cells of the leaf. The starch, or starch changed to sugar, is carried by sap through the tree and is an important substance in building its structure.

Leaves also evaporate or give off water into the air. By disposing of water in this way, room is made for soil water to move up into the tree carrying plant food from the soil.

When leaves shed they form a bed on the forest floor which eventually decays to form leaf mold. The elements of plant food in the decayed leaves are then taken up by the tree roots. Thus trees, to this extent, feed on themselves.

Food of Trees. Like any other plant life, trees require ten elements of plant food—carbon, oxygen, hydrogen, nitrogen,

phosphorus, potassium, calcium, magnesium, iron and sulphur. Carbon and oxygen are taken in through the leaf. All the others are taken in through the roots.

Water, which is a combination of oxygen and hydrogen, is the plant food carrier. It not only moves up from the soil through the roots as sap, but it circulates all through the structure of the tree before passing off into the air as invisible fog from the leaves.

A very peculiar and interesting thing is that the sap water moves uphill, climbing from the foots to the topmost twig. A force not easily described, causes this movement of water upward. It is called osmosis, which is to say, the ability of water to soak through the structure of the cells in an effort to distribute itself evenly throughout the plant and to keep the moisture in the plant from being too dense or strong with chemical elements. Since water is constantly evaporating from the leaves, this keeps water moving upward to replace that which is lost through evaporation.

In the sap is dissolved plant food which the cells of the tree structure absorb. In each cell there is digestive power to convert plant food into tree growth substance. Plant food moves largely through the tissue immediately under the bark. This tissue is called the "cambium layer." When one chops through the cambium layer all around the tree trunk the tree, of course, is deprived of its needed plant food and it dies. This is called "deadening the tree."

Age of Trees. When a tree is sawn down, the trunk shows a series of rings. Each ring represents a year's growth, and one can, of course, count the rings and learn how old the tree is. Some of the rings will be found wider apart than others, the narrow rings indicating drouth, forest fire damage or some other injury.

Forests and Fires

The greatest enemy of forests is fire and, since man is largely responsible for fires, he is most to blame. Fires do not

have to be raging flames of large proportions to do damage; but ground fires burning only the bark, leaves, twigs and leaf mold do very serious injury in the following ways:

1. Tree seed are destroyed.

2. Young trees are killed.

3. Older trees are scorched, weakening their vitality and allowing the entrance of decay, thus slowing up tree growth.

4. By destroying the mulch of leaves and leaf mold, less rain water is soaked up and more of it runs off the surface to cause bigger floods with their destruction to life and property. It has been shown that the leaf litter on the soil of an unburned forest holds seven times as much rain water as that on soil that has been burned over every year. By fire reducing the water absorbing power of the soil the volume of the flow of springs and streams between floods is reduced. This means that the amount of available water power is lessened, a serious matter in this age of hydro-electric power.

In burning the leaves and leaf mold the fires destroy the rarest and most needed form of plant food, nitrogen, an element that has most to do with tree growth. Thus, forest soils are made poorer.

Reforestation and Floods

Georgia has about 23,000,000 acres in forest. About 6,000,000 acres of abandoned or unprofitable farm lands should be reforested. With 29,000,000 to 30,000,000 acres in forest and with cultivated, sloping lands properly terraced, disastrous floods could largely be averted. Georgia has the control of its floods in its own hands because all the main streams in the state rise within its own borders.

Abandoned uplands now being washed away and converted into unsightly gullies could be changed into forest lands with little trouble. Usually there are seed trees near the old

fields that are spreading their seed with the help of the wind over these waste lands. The seed find no trouble in starting growth, but too often someone sets fire to sedge grass in the old field and the little trees are burned to death.

Where there are no seed trees trying to reforest old fields, young trees can be planted. This is done by getting seedlings from tree nurseries and planting them, or by digging up young seedlings from the forest and setting them out in the field. The methods to be used will be discussed further on in this publication.

Not only are abandoned lands and poorly terraced lands damaged by washing, but nearby streams are often clogged with sand bars so that rich bottom lands are overflowed and become water-logged and swampy, rendering them unfit for cultivation.

Reforesting will, therefore, not only convert old fields to some use but it will help save the bottom lands; and terracing cultivated lands will not only help preserve bottom lands but check the enormous annual loss of soil plant food that flows away in streams.

One reason why land owners do not plant trees is that a crop of timber can not be harvested from the land the same year the seed are planted as is the case with cotton and corn. The question might be asked here: "Will growing a forest pay?"

Will Forest Growing Pay? In answer, it can be said that it will. It has been shown how forests will help reduce flood damage, how they help to keep up the flow of springs and streams between floods, thus conserving water power and also protecting bottom lands.

But a tree crop will pay without taking those things into consideration. Take pines, the greatest forest crop of Georgia. A good crop of pines will grow wood at the rate of a cord or

more per acre each year, or the equivalent of 500 board feet of lumber. Of course, one must wait for the harvest, but each year that much value is being added to each acre of the land. Then remember that idle land does not produce anything, in fact, is a source of annual loss. By reforesting, the land becomes productive, yielding timber growth annually worth from $5 to $8 an acre. Is that not worth while?

Remember, however, that this can be accomplished only when fires are kept out.

Suggestions

Identify leading commercial trees by classes in the school forest, using the bulletin "Forest Trees of Georgia," issued by the Forest School of the Georgia State College of Agriculture. Find the largest tree of each species.

Observe the effect of light on the development of a given species of tree in the open or on the edge of the forest compared with trees in the denser part of the forest.

Study the adjustment of leaves on limbs and twigs so as to be exposed to the maximum amount of sunlight.

Make a collection of the different seeds of trees in the forest. Study facilities of the seed for distribution.

Dig up a young tree (do not take it from the demonstration forest), and study the tap root, lateral roots and the small feeding roots. Study the bark, the cambium layer of cells, the structural divisions and count the rings denoting annual growth.

Visit old fields where trees are checking erosion.

Note pine seed trees near old fields and how widely they are scattering seed and starting new growth. Observe where fires have destroyed young pine.

Study the germination and root development of seeds in the laboratory.

PART II

Trees of Georgia

From the mountain crests of Georgia to the tidewater of the Atlantic Ocean, 163 species of trees have been found. Stretching north and south, the state has a wide latitude. From a 5,000 feet mountain altitude in the northern part of the state to the sea level the state has quite a variation in altitude. On account of its latitude and altitude, Georgia has trees on its mountain tops that naturally belong to the far north, while on its southern border are trees of semi-tropic nature. Thus the state has an extraordinary number of species of trees.

Geographically, Georgia has three main divisions; the Coastal Plain, the Piedmont area and the mountain. The predominant trees of the coastal plain are pines. In the Peidmont area pines and hardwoods are about equally divided, while in the mountain area hardwoods predominate.

While a few trees seem at home in any latitude, at any altitude and on almost any kind of soil, most of them have preferences. Spruce and hemlock and white pine, for instance, are at home only on the high, cool altitude of the mountains. Cypress does not mind wet feet and grows in swamps and develops "knees," curious enlargements of the lower trunk to help underwater growth. Some trees like to be in water at least part of the time, such as black gum. Many trees like rich, moist soils and are found along streams, borders of swamps and ponds and in bottom lands. Among these are the sycamore, poplar, tulip, red gum, cottonwood, beech, some of the oaks, willow, magnolia and some of the pines.

Some trees like fertile soil, whether in the coves of the mountains, on bottom lands of the valleys or on fertile lands of the coastal plain. Such are the walnut, locust, poplar, cer-

tain hickories and the pawpaw. When the state was first settled lands were chosen for fertility by the kinds of trees they grew, and the first classification of soils was by the kind of tree growth on the land.

Some trees care only for dry soils, some are most abundant on sandy soils, others on clay soils. Some, like the scrub oak, have taken possession of poor soils of the sand hills.

The distribution of the trees of Georgia may, therefore, be said to be largely according to latitude, altitude, swamps, semi-swamps, stream and swamp borders, sandy soils, clay soils, rich soils and poor soils.

Trees and Shrubs. The question may be asked "How is a shrub to be distinguished from a tree?"

A tree is usually considered as any forest growth that has two inches or more of trunk diameter and ten feet or more in height. A shrub is a growth that at maturity may be less than two inches in trunk diameter and less than ten feet in height.

Commercial Trees. Since this publication is about commercial trees, the question may be asked in this connection, "What constitutes a commercial tree?"

In this discussion, an important commercial tree will be considered to be any tree the wood or product of which is used for the manufacture of articles offered for sale. This, of course, excludes trees sold for ornamental purposes or plantings for shade. The number of important commercial trees in Georgia is placed at 53, but many of these are of minor importance.

Wood Manufacturing In Georgia

Lumber. According to the census of the United States for 1925, Georgia had 1,105 saw mills, sawing approximately 1,-500,000,000 board feet of lumber and employing an average of

14,875 workmen daily throughout the year who were paid annually $10,600,565.00 in salaries and wages.

As would be expected from its great pine forest area, the species of tree producing the most lumber is the pine. The census of 1925 showed that 85 per cent of all lumber sawn in the state, or 1,172,640,000 board feet, came from the pine.

Trees sawn into lumber in Georgia during the year reported by the Federal census and the amount of lumber from each are as follows:

Species	No. Board Ft.
Yellow Pine	1,172,640,000
Cypress	62,709,000
Oak	39,889,000
Yellow Poplar	37,082,000
Red Gum	35,095,000
Ash	6,159,000
Tupelo	3,215,000
White Pine	2,302,000
Maple	1,302,000
Sycamore	1,281,000
Chestnut	1,042,000
Cottonwood	730,000
Hemlock	524,000
Hickory	493,000
Basswood	133,000
Beech	61,000
Birch	12,000
Elm	9,000
Cedar	6,000

Cooperage. Georgia produces a large number of wooden barrels each year for shipping naval stores products (rosin and turpentine), oil, tar and other manufactured products; for shipping tobacco, potatoes, and other agricultural products. In 1925, 240,023,000 staves and 23,052,000 headings were made

for tight cooperage, and 937,597,000 staves and 71,371,000 sets of headings for slack cooperage.

In the manufacture of tight staves and headings, Georgia used white oak, red oak, pine, red gum and ash, mainly. For slack headings and hoops, producers in Georgia used pine, yellow poplar, elm, cottonwood, tupelo, oak, birch, red gum and maple.

Much the greater part of cooperage of all kinds is produced from pine in Georgia. Elm is the favored wood for making hoops. In 1925, 477 establishments were manufacturing cooperage products. In many cases, turpentine stills are also producers of barrels.

Shingles. Seventeen Georgia producers of shingles in 1925 turned out 18,762,000 shingles. Most of them were made of pine, but chestnut, cypress, ash and oak were also used.

Laths. Georgia produced 22,186,000 laths in 1925, pine being the wood almost exclusively used.

Boxes. Wooden boxes are made of various kinds of wood. Ten wooden box manufacturers employing 1,054 people are turning out boxes of all sorts valued at about $1,500,000 each year. Pine, poplar, oak, chestnut, gum, cypress, tupelo and cedar are among the leading species of trees used in box production.

Baskets, Hampers and Crates. A great many baskets and crates are used each year to ship Georgia peaches, apples, cantaloupes, potatoes, beans, lettuce and other vegetable crops. Most of these are made from pine, but poplar, gum, chestnut, cottonwood and other less important trees are used. Willow and pine needles are used to some extent in basket making.

Veneer. Many different kinds of trees in Georgia are manufactured into veneer. In 1925, Georgia converted 11,412,000 feet of logs into veneer. Veneer is made by making thin layers

of wood. This is usually done with a sharp blade that cuts as the log rolls and makes a continuous sheet of wood. These sheets are then glued to the surface of less valuable wood employed in manufacturing furniture, desks, doors, panels, etc. Some of the cheaper woods are used to produce veneer used in making baskets and fruit and vegetable containers. Among the Georgia woods used are walnut, cherry, red gum, poplar, magnolia, oaks, sycamore, cypress, basswood, tupelo, birch, cottonwood, maple, cedar, elm, willow, ash, beech.

Furniture and Fixtures. In the manufacture of household furniture, office desks and fixtures, Georgia does not take important rank among the states, but about 2,500 people are engaged in this line of manufacture. Leading materials used are oak, walnut, red gum, poplar, pine, cypress, magnolia, cottonwood and maple. Imported mahogany is also used.

Excelsior. This product made by producing thin shavings from wood is used for packing material, pads, etc. One form is known as pine wool where the pine is broken down into fibre resembling wool. Practically all excelsior made in Georgia is from pine. Cottonwood and basswood are also important sources in other states.

Turnery. Among articles of this class are handles, rollers, spools, bobbins, bowls, rolling pins, ladders, kitchenware, etc. A number of woods are used for this purpose, among them being poplar, pine, gum, sycamore, dogwood, persimmon, ash, hickory, birch, beech, elm, basswood, tupelo, locust, sassafras, bay and gum.

Pulpwood. Both pines and hardwoods are accepted by paper mills. The wood is bought by the cord with specifications that the pieces are not to be less than four inches in diameter. This demand is growing and promises to provide in the future a ready market for tops of trees cut for saw logs; for timber that should be cut to properly thin a forest; for species of trees not acceptable for lumber; for saw mill waste and storm damaged timber.

Wood Preserving. Georgia has some large timber preserving plants, where telephone and telegraph poles, cross ties, piling and fence posts are impregnated with creosote. This treatment retards decay and prolongs the usefulness of wood that comes especially in contact with the earth and water. The wood preserving industry of Georgia turns out products worth annually nearly $4,000,000.

The woods used are such as are employed as poles and posts, such as chestnut, cedar, pine, cypress and gum.

Planing Mill Products. Many saw mills also operate planing mills but there are many planing mills that are independent of the saw mills. Planing mills not only smooth the rough surface of sawn lumber but many of the plants manufacture doors, sash, window and door frames, floors, ceilings, plywood, silos, tanks, molding, panels and so forth. The total annual output from 125 plants of this nature in Georgia is about $41,000,000.

In this line of wood manufacture, all sorts of wood adapted to use for these purposes are employed. For floors, oak, maple, pine, red gum, chestnut and other straight-grained, smooth woods are employed. For doors, window frames and sash, pine, cypress, poplar and chestnut are most commonly employed. For ceiling, pine, poplar, chestnut, cypress, red gum, maple, ash and other woods are desirable. Interior finishing, panels, and so forth, require oak, red gum, cypress, beech, birch, walnut, maple, cedar, magnolia, poplar and a number of other Georgia woods.

Forests and Water

In the previous chapter something was given about how fire reduces the water-holding capacity of the forest floor; also, what effect keeping down forest fires and reforesting old fields would have in reducing the danger of floods. It might be asked, "How do the leaves and leaf mold reduce the surface

run-off of rain?" It is well to know the "why" of everything one possibly can.

A forest floor covered with leaves and twigs in various stages of decay, including the porous leaf mold and the humus which is finely broken-down organic matter, is capable of absorbing or holding back rain fall and preventing it from running off the surface. There are three ways in which this is done:

1. The leaves and twigs offer resistance to water flow. The longer the water is held in place the greater the opportunity for it to soak downward into the soil.

2. The decaying and decayed leaves are somewhat like sponge in their ability to absorb water.

3. When vegetable matter breaks down into soil particles, these particles are extremely small, some being even smaller than particles composing clay. The smaller the particles of soil, the more water the soil will hold, for every particle is surrounded by a film of water. This is why muck soil or other soil made largely of vegetable matter holds so much more water than sand or sandy soil.

The above reasons show why the forest soil from which fires have been kept will catch and absorb rain water, but it may be added that decayed roots provide channels for carrying water downward, and live roots aid in a measure in the same way.

Rain water gets away from the soil in four ways: (1) By running off of the surface into the streams. (2) By seeping downward into springs and, finally, into streams. (3) By entering the roots of trees and plants of all sorts and evaporating into the air through the leaves. (4) By evaporating from the surface of the soil into the air.

The loss of water by soil surface evaporation is not of much consequence in a forest, for it is checked by leaves on the

ground and by shade keeping the ground cool. One can readily see a difference between the moisture content of soil under leaves and the soil of an open, cultivated field during dry weather.

With forest fires kept out and the forest soil allowed to store a maximum amount of water, the result will be that springs and streams will have a larger constant flow. This means, as we have seen, that there will be more water power available throughout the year, which is of general importance because most of the electricity used in Georgia comes from water power. If it were not for water power our electricity would be more expensive.

Suggestions

Find out how many species of commercial trees are represented in the demonstration forest. Which species predominate in the forest?

Find out which trees are the tallest, which have the greatest amount of log timber suitable for lumber; which will produce the most cordwood.

Sketch leaves and seed of leading species of trees in demonstration forest.

Test water-holding capacity of forest soil and cultivated soil by filling two flower pots of equal size, each having a hole in its bottom. If the wood soil is fluffy, it should be packed tightly into the pot. Pour slowly a measured amount of water into each pot. Note how much water is required in each instance before water begins to leak through the hole in the bottom.

To observe how much humus, or organic matter, is destroyed by fire, weigh a given amount of forest soil. Subject it to a hot fire and then weigh again.

Arrange a debate on the question of which is the most useful of the two leading commercial species of trees in the demonstration forest.

What wood-working industries in Georgia use different species of trees in your demonstration forest? See Bulletin, "Uses of Georgia Woods," issued by Georgia Forest Service.

Which trees in the demonstration forest put out leaves first in the spring?

PART III

Pines of Georgia

Georgia's greatest resources are connected with the pine which covers more than half the forested areas of the state. The pine area is increasing because of the greater ability of the pine to reseed old fields and to take possession of other areas from which hardwoods have been removed.

Pines are found in all parts of the state, predominating in the coastal plain and the lower part of the Piedmont region. In the lower part of the state and especially on moist lands the slash pine predominates. North of the slash pine area the longleaf exceeds all other kinds. In the upper coastal plain and lower Piedmont the loblolly is most abundant. In the upper Piedmont and foothills the shortleaf pine is the most important of the pine species.

While these are distinct pine species belts, there is considerable intermingling. The loblolly is found in the slash and longleaf area. The longleaf is interspersed with the slash, usually occupying the dryer areas; likewise, the slash invades the wetter soils of the longleaf area. The shortleaf of the upper part of the state is found in areas of the loblolly belt. Isolated areas of longleaf are also found well up in this loblolly area.

The three species of pine of greatest commercial importance in the state are the slash, longleaf and loblolly. Shortleaf pine produces a fine quality of lumber but is not as abundant as the other three species. Slash and longleaf pines produce turpentine; the others do not yield enough turpentine to make it profitable to use them.

The lumber market groups all four species into "yellow pine" and makes no distinction between them, but the shortleaf has a stronger, denser wood because of its slower growth and, for some purposes, its wood is superior.

In addition to the four leading species of pines mentioned, Georgia has the "pitch pine" which grows on the mountains. Its wood is brittle, soft and used only for rough lumber. It is also suited for wood pulp.

A species of pine in some places attaining considerable commercial importance in the coastal plain is the pond pine or black pine. It is sold as yellow pine. A peculiarity of this species is that it will put up sprouts from the stump.

Other pines of the mountain region are the scrub pine and the white pine. The wood of the scrub pine is very knotty and useful only for rough lumber and wood pulp, while white pine makes excellent lumber.

A spruce pine is also found in bottoms and river swamps of the coastal plain, nowhere in abundance. The wood is brittle, close-grained and warps badly. It would be available as a source of wood pulp.

In learning how to identify the pines of Georgia, the student is referred to a publication entitled "Forest Trees of Georgia," issued by the Forest School of the Georgia State College of Agriculture.

Reproduction of Pines

A peculiarity of the longleaf pine is that it does not produce seed every year. At times as long as seven years may

intervene between seed crops, but usually the time is about five years. The loblolly and slash are usually annual seeders. This accounts for loblolly and slash pine often taking over areas formerly occupied by longleaf. When a woods fire kills a young longleaf pine, it may, therefore, take several years for the young tree to be replaced by natural processes.

Vastly more seed are scattered than ever germinate and start growth. Some may not fall where they can make contact with the soil. Many are consumed by birds and wild animals as the pine seed is one of their favorite foods.

Growth Habits. As soon as pine seed germinate much of the young plant's first growth is put into the tap root. Pines, as we have learned, require strong, deep tap roots to anchor their tall growth firmly in the ground. The longleaf pine, especially, concentrates on the development of its root system for the first two or three years, making no upward growth during that time.

The slash pine does not require as much time to get started. It makes more growth for 20 to 30 years after it starts than the longleaf, but the longleaf's annual growth usually surpasses slash after that time. Because of the early rapid growth, slash pine is generally used in reforesting in the Southern part of the state.

One of the enemies of the young pine is the hog, sometimes referred to as the "piney woods rooter." The roots of young longleaf pine especially are uprooted and fed upon. Sometimes injury of this character to slash pine has been noted but this is unusual.

Naval Stores Industry

Georgia produces more naval stores (turpentine and rosin) than any other state. Savannah is the greatest naval stores market in the world. Brunswick is also an important naval stores exporting point. Sixty-five counties in South Georgia

produced, according to the census of 1926, naval stores valued at $23,000,000.

The longleaf and slash pine are drawn upon for these materials, other pines being too low in producing gum to make their use profitable.

Different terms are used for describing the chipping of the sides of the trees for turpentining. "Facing," "boxing" and "cupping" are most commonly used.

Methods of Turpentining. "Boxing" is used to describe a method of deep cutting of the tree. This is a destructive method and in recent years has been largely replaced by the "cup-and-gutter" system. The advantages of the cup-and-gutter system over boxing are: (a) The yield of turpentine is greater and the quality of rosin better. (b) The loss and damage from fire is reduced. (c) The tree is stronger and less liable to be blown down by winds.

A method used in France and known in America as the "French method" consists of lighter chipping with narrow, oval face. This does not wound the tree so much, the scars heal over more quickly and the life of the tree is prolonged.

Some comparisons made of the American with the French method show more production by the American, but others show equally as good yield from the French. At any rate, by keeping up the vigor of the tree and lengthening its life and the period of turpentining, the French method would probably be the more profitable in the long run. A combination of the American and French methods is among the future possibilities in the South.

Mistakes in Turpentining. The greatest mistake made in turpentining is in using small trees. No tree less than 8 to 10 inches in diameter at four and a half feet from the ground should be cupped. It is not profitable and the young tree's

growth is hindered so much and weakened to such an extent that fires and high winds frequently destroy it.

Not more than two faces should be allowed on any tree, and two faces should be made only on trees 14 inches in diameter and over. For trees 12 to 14 inches in diameter, the face should not exceed 8 inches in width, and those on trees above 16 inches in diameter should not exceed 10 to 12 inches in width. The height to which a face should be increased in any one year should not be more than 16 inches; that is, one-half inch to 32 streaks a season. No streak should be deeper than one-half inch into the wood under the bark. This is known as "light chipping." Before chipping begins the bark on the surface to be chipped should be scraped off clean. This makes a higher grade rosin.

If these general rules are followed, pine trees can be turpentined satisfactorily and also make fair growth. It is important that abundant growth bark be left. This can not be done if trees are too small when faced, or if the faces are extended so as to leave too small growth bark, but by following the above rules, this will be avoided and trees treated in this way will continue to grow at about two-thirds of the rate of the natural growth they would attain without turpentining. Thus turpentined trees can grow up into timber suitable for lumber, and because of their double use, the longleaf and slash pines are often spoken of as "dual purpose" trees.

Fire Hazard. Because of the combustible nature of pine needles on the ground and of the gum on the surface of the chipped face of the tree, precautions must be taken to keep down fires. It is customary to rake the needles and grass away from the base of the trees for two or three feet and many turpentine operators then burn off the forest floor.

The more modern and economic method is to put in fire breaks, patrol the area, maintain fire towers and fire fighting equipment to suppress fires. We have already learned how

fires destroy the fertility of the forest soil and retard growth. For the same reason, fires will cut down the yield of turpentine, certainly when a long period is averaged, because fires reduce the growth of trees.

Uses of Naval Stores. As the name indicates, the products obtained from turpentining trees are used by the ship-building industry. This was its first important use. Now these products have many uses. Turpentine is employed in paints, varnishes, in making explosives and chemicals of various kinds. Rosin is used for manufacturing varnish, paper, sealing wax, soap, ship's caulking, in medicines, printers' inks, on violin bows, shoemakers' thread, and so forth.

Pine Wood Uses. From Georgia's pines come the greater part of the lumber, laths, staves, boxes, poles, crates and excelsior produced in Georgia. It promises to be an important source of wood pulp as it already is in some other Southern states. Quite an industry has developed in Georgia by uprooting pine stumps and extracting the turpentine. Pine needles are woven into baskets and fancy articles of various kinds.

The heart wood of pine is hard and quite durable, even when in contact with the earth. The sapwood, or outer layer of the trunk of the pine is comparatively soft and decays rapidly when exposed to rain if it is not protected with paint or creosote.

Other Conifers. Cedars and cypress are other species of trees belonging to the conifer or pine family. Red and white cedars are found in Georgia, the red being most common. It is used for lead pencils, posts, poles, chests, interior finishing and so forth. The white cedar, or juniper, grows in low, moist and swampy lands of South Georgia. The wood is light, soft, cross-grained and is used for boat and canoe building, cooperage, shingles and fence posts

Cypress grows in swamp and wet land areas of South Georgia. It has a straight trunk with broad buttressed base

and "knees," peculiar to the tree as a means of providing the roots additional contact with the air. The limbs are usually festooned with aerial moss. The wood is light, soft, easily worked, light to dark-brown in color and is very durable. It is used for both exterior and interior finishing, for boat and ship building, shingles, posts, poles, crossties and so forth.

Georgia's Hardwoods

In a previous discussion of the uses of Georgia woods something has been learned as to the main wooden products. Now we are to learn something about the character of the wood of the various leading hardwood trees which adapts them to different uses.

The principal commercial hardwoods of Georgia are the oaks, hickories, poplar, chestnut, birch, beech, red gum, black gum, magnolia, sycamore, locust, wild cherry, maple, ash, basswood, dogwood, persimmon, tupelo, cottonwood, willow and walnut.

The uses of Georgia woods are described in detail in Bulletin Number 5 entitled "Uses of Georgia Woods" of the Georgia Forest Service, and "Forest Trees of Georgia," issued by the Forest School of the Georgia State College of Agriculture for tree identification should be consulted for more detailed information.

Oaks. All the leading varieties of oaks are found in Georgia, namely: White oak, post oak, chestnut oak, basket oak, live oak, red oak (Southern and Northern), black oak, scarlet oak, turkey oak, blackjack oak, water oak, willow oak, laurel oak and overcup oak.

White oak is commercially the most desired because of its heavy, strong, hard, tough, close-grained and durable wood which is light brown in color. White oak wood is used for furniture, wagons, shipbuilding, flooring, interior finish, tight

cooperage and general construction, and the trees are suitable for highway planting.

Post oak is employed for most of the purposes for which white oak is used. The wood is light to dark brown, close-grained and durable in contact with the soil, making it also durable for cross-ties, fence posts, bridge timbers.

Chestnut oak wood is similar to white oak, also, and is used for the same purposes. A swamp chestnut oak, or basket oak, is used for making baskets, also for lumber, veneer, tight cooperage and fence posts.

Red oak, sometimes called Spanish oak, is used for rough lumber, tables, chairs and interior finishing. Its color is light reddish-brown. The northern red oak is found most commonly in the mountains. It has light reddish-brown heartwood and lighter colored sapwood. It is used in the same way as southern red oak.

Black oak, also called yellow oak, has hard, coarse-grained wood of the same appearance as red oak, under which name for similar purposes it is sold.

Overcup oak is not found in abundance. Its wood is used for the same purposes as white oak.

Other oaks are not of much commercial importance in Georgia. Live oak is especially desirable for highway and park planting. Water oak and scarlet oak are also used extensively for ornamental planting.

Hickories. Georgia's leading hickories are the scaly-bark, whiteheart, bitternut, pignut and pecan. All species of hickory have heavy, tough, hard, strong, flexible woods that adapts them to use for tool handles, wagon construction, agricultural implements, athletic goods and so on. Pecans, of course, are prized too highly for their nuts to be grown for lumber. Hickories make good highway and park trees.

Poplar. Also known as the tulip tree, is a stately tree that grows in all parts of the state and has been an important source of light, soft, easily worked lumber. Its color is light-yellow to brown. Its wood is used for lumber, interior and exterior construction, veneers, vehicle bodies, turnery and so forth.

Chestnut. A tall growing tree of the mountains and Piedmont area of the state, bearing edible nuts in prickly burs, is rapidly disappearing because of the chestnut blight. Its wood is light, soft, easily worked, and very durable but not strong. It is adapted for making poles, posts, crossties, lumber and interior finishing. The bark and wood are also used by tanneries.

Birch. River or red birch and black birch are found in Georgia. The river birch is found along borders of streams, ponds and swamps. Its wood is used for woodenware, turnery, wagon hubs and so forth. Black birch is found in the mountains. Its wood is dark-brown, giving it a local name of mountain mahogany. Its wood is used for furniture, flooring and trimming.

Beech. Three species of trees growing in Georgia are called beech, blue beech and hornbeam or ironwood. The hornbeam or ironwood grows in the northern part of the state. Its wood is light-brown, strong, hard and durable. It is used for fence posts, handles, and mallets.

Blue beech, or water beech, is found along low grounds. Its wood is tough, close-grained, heavy and strong. Among its uses are levers, tool handles, mallets, wedges and so forth.

The beech most widely distributed over the state grows in association with hickories and oaks on well-drained, rich soils. This species has its three-sided nuts in prickly burs. The wood is used for furniture, flooring, tool handles and novelty ware.

Gum. The red gum, or sweet gum, which grows in rich bottom lands along streams and swamps is a very valuable com-

mercial tree. Its fruit is borne in prickly balls. The wood is very popular for veneer used on furniture, interior finishing and so forth. The dark wood makes it suitable for use in the place of mahogany and Circassian walnut. It is also desirable for ornamental planting.

Black gum, often called sour gum, grows in lowlands, swamps and on dry slopes, being by nature adapted to varying conditions. It is looked upon as a "weed" among forest trees, but is finding use in making crates, baskets, veneers, rollers, mallets and pulp wood. The black gum is not kin to the sweet gum.

Magnolia. This tree is perhaps the most popular ornamental tree of the state. It grows wild in the coastal plain area and is cut for lumber and veneer. Its wood is moderately heavy and hard with a creamy color. It makes a choice interior finishing.

Locust. The black and honey locust grow in Georgia. The black locust grows in the upper half of the state, usually in thickets. The wood is yellow, coarse-grained, very heavy and hard, strong and durable in contact with the soil. Its chief uses are for fence posts, poles, insulator pins and tree nails.

Honey locust is known for its long pods containing yellow, sweetish pulp and seed which are eaten by animals and birds. The coarse-grained wood is hard, strong, durable and is used for fence posts and crossties, but it is not as durable as black locust.

Cherry. Black cherry or wild cherry reaches its largest development in the mountains. The wood is reddish-brown with yellow sapwood. It is strong, fine-grained, valuable for its lustre and color. It is used for furniture, interior finish and handles. Next to black walnut it brings the highest price of any timber in the state.

Maple. Three species of maple grow in Georgia, the white

bark, red and silver. Whitebark maple is common to the Piedmont area. The wood is hard, strong, coarse-grained and tough. Red maple or swamp maple is distributed widely over the state. Its wood is soft, close-grained and weak, and light-brown in color. Silver maple is rare, growing on moist lands. It has drooping limbs turned up at the tips. The wood of maple is used to some extent for furniture, turnery and woodenware.

Ash. White ash is common to the northern half of the state. Its wood is valued for its toughness and flexibility, making it desirable for tool handles, athletic goods such as rackets, bats and oars. It is also used for furniture and interior finish.

Basswood. This is also called linden or lin. The trees of this class grow mainly in the mountains. The wood is light, soft and tough. It is light-brown in color and is used for woodenware, furniture, trunks, excelsior and wood pulp.

Tupelo. Tupelo gum is found in lowlands along rivers and swamps of the coastal plain. The wood is light, soft but not strong. It is used for woodenware, cigar boxes, broom handles, light vegetable and berry boxes, crates and veneer. The wood of the root is very light and is used for floats of fish nets.

Cottonwood. Grows in low, moist land in the lower part of the state. Its wood is soft, inclined to warp, and is used for veneer, wood pulp and in connection with engraving for printed illustrations.

Walnut. Black walnut grows chiefly on moist, fertile slopes of the middle and northern part of the state. The heartwood is a rich, chocolate brown in color, susceptible of high polish, and is prized for many uses such as furniture, desks, cabinets, gunstocks, airplane propellers, and veneer. The nuts, of course, are valuable as food and the tree is desirable for ornamental planting.

Sycamore. The sycamore with its white bark stands out conspicuously summer and winter along streams, swamps and in ravines and coves in all parts of the state. Its wood is hard and moderately strong, but decays rapidly in contact with the ground. It is used for veener, tobacco boxes, interior finish, butchers blocks and furniture. This tree is extensively planted for ornamental purposes.

Persimmon. This tree is common throughout the state except in the high mountains. It is abundant in old fields. The wood is hard, dense, heavy and strong. The sap wood is white and the heart wood brown or black. It is valuable for textile mill equipment such as shuttles, spools and bobbins; also for golf stick heads and other special uses. The fruit is valuable as food for animals.

Dogwood. This small tree makes its presence known with a burst of beautiful white blossoms in the spring throughout the state. Its close-grained, hard wood is in demand for cotton-mill uses as is persimmon, but it is also used for turnery, handles, and so forth. For ornamental purposes the dogwood is highly prized.

Willow. Black willow is found along streams in all parts of the state. Its wood is soft, light, but not strong, varying in color from light-brown to nearly black. Its wood is used to produce high grade charcoal, for making artificial limbs and turnery. Its twigs are used for plaiting to make rip rap for use along streams to prevent swift currents from cutting into the banks.

Other trees than these mentioned are used for lumber, posts, crossties and the like, but are not of sufficient importance to be ranked among the leading commercial trees of Georgia of which this publication treats.

Forest Thinning

The chief reason for thinning is to help the forest area to

produce a maximum amount of merchantable timber, just as we thin corn and cotton stalks to space the plants so they will produce the largest crop yields.

Left to themselves, trees vie with each other for the soil fertility, soil moisture and sunlight until the stronger suppress the weaker. That is the way nature does thinning, but man can improve on that.

Undesirable, or the least valuable, trees can be removed to give the more desirable trees a chance to grow faster. Mature trees, that is trees that have attained full growth, can be harvested to give the young tree a chance. Diseased or damaged trees can be taken out for the sake of the healthy trees. The main objective in thinning is to give trees space for rapid, full development.

Thinning Pines. Pines usually come up thickly. To cause the trees to grow up into straight, clean, tall trunks, it is essential that they be allowed to grow thickly until they have attained about four to six inches in diameter. By so doing the process of natural pruning takes place. At this size the thinnings have a market value as poles, pulp wood, fence posts and firewood, and instead of thinning being an expense, it will be a source of profit. At times, however, pines may be so thick that it will be necessary to thin before they gain commercial size.

At the first thinning about 450 trees may be left per acre. As the trees mature other thinnings will be needed. Trees suitable for turpentining may be turpentined and then used for lumber, poles, pulp wood or fire wood. This leaves other trees room for the fullest growth and also provides more room for young growth to come on for the future forest.

Thinning Hardwoods. Hardwoods usually grow in mixed stands, often having pines interspersed. The problem of thinning involves the question of what the owner prefers to grow, and his decision will naturally be to promote the growth of the

tree that will produce wood for which he has the best market. The conditions may be such that more than one species of tree in the forest area should be promoted by thinning.

In selecting the trees to be removed one should consider cutting out mature trees, suppressed trees, diseased trees, crooked trees and undesirable species of trees that are interfering with the growth of desirable trees.

The next consideration should be to remove trees that are in too thick a stand to permit of satisfactory growth. This leads to the question: "How thick should hardwood trees be for proper growth?"

A good rule to follow is to have the trees at least far enough apart so that their crowns barely touch. As the trees continue to grow, some will overtop and begin to crowd out others. In such cases, remove the least thrifty tree. In case the tree that is being crowded out is more desirable than its competitor, preserve it and cut out the less desirable tree. It will thus be seen that thinning should be continued from time to time as trees crowd each other.

It is, of course, always desirable to have a market or use for the thinned timber, whether as lumber, poles, fence posts, wood pulp or firewood. Before beginning to thin it is well to arrange for the best disposal of the cut timber.

Suggestions

Face pines for turpentine in the turpentine belt. Compare usual method with French method. Compare the yield carefully.

Note the rate of growth of pines faced on one side as compared with trees faced on two sides; faced in the ordinary way as compared with the French method; and growth of properly turpentined tree as compared to one not turpentined.

Compare turpentine yield of trees subject to forest fires with those not subject to fires.

Measure carefully the circumference of different trees each year at 4 1-2 feet high to note rate of growth. Measure extreme length each year.

How many kinds of hardwood used commercially can be found in a determined distance of the school?

Which tree in your school forest has the hardest wood? Which will split the easiest? Which will make the best handles? The best mallets?

Designate trees that it is thought might be removed for thinning purposes.

Suggest the best uses of trees that could be removed in thinning.

PART IV

Estimating Standing Timber

To sell standing timber intelligently one must know how to estimate the board feet of lumber or cords of wood or crossties, as the market may demand. It is not difficult to learn enough about estimating to at least have a fair idea of the forest resources.

In estimating large timber areas, the plan is to take typical section and figure the whole on that basis.

Definitions

It is essential to have a few facts to use in estimating standing timber.

A board foot is equivalent to a board one inch thick by one foot square.

A cord of wood is 128 cubic feet. Expressed another way, a pile of wood 4 feet high, 4 feet wide and 8 feet long makes a cord. A cord of wood averages about 500 board feet, varying more or less according to the size and shape of the sticks.

A standard crosstie is 6 inches by 8 inches by 8 feet in dimensions and 7x9 inches by 8½ feet.

In estimating the *volume* of trees, a diameter measurement is made 4 1-2 feet above the ground. This is called Diameter Breast High and is referred to as DBH measurement.

In estimating the area covered it will be convenient to know that a strip 66 feet wide (a chain) and 660 feet long makes an acre. A circle whose radius is 59 feet will make one-fourth of an acre. A square 208.71 feet in dimensions makes an acre.

Tree Measurements for Lumber

While there are instruments for estimating the board feet volume of a tree by merely taking a diameter measurement 4 1-2 feet high, using different figures for each species, for beginners it is doubtless better to follow the method of taking diameter and height measurements and using standard volume tables that have been worked out for the purpose.

In taking the height measurement, one of several measuring sticks can be used, the one most commonly used in the South being the Biltmore stick. Another device is the hypsometer recommended by the United States Forest Service. Full directions for the use of these instruments come with them. The estimator stands a given distance from the base of the tree, holds the stick at arm's length, the lower end of the stick sighted so as to be in line with the eye and the base of the tree. The figures on the stick in line with the eye and the uppermost part of the tree suitable for a log will give what is desired. Log lengths of 16 feet and half log lengths of 8 feet are usually employed in these estimates.

The breast high measurement (4 1-2 feet) of the diameter of the tree can be made with a carpenter's square, but with calipers it can be made more conveniently, if not more accurately. The calipers is similar to the carpenter's square except that it has two arms instead of one, one of these arms being movable so as to quickly adjust to the tree and record the diameter.

With the height and diameter determined, the next step is to consult the volume tables above referred to, one for hardwood and another for pine. The volume of board feet is given in the table. This can be set down on a card made for the purpose, and then one can go on to the next tree.

If a strip 66 feet wide and 660 feet long is estimated, one acre is covered. If this is a typical area, one may multiply the amount of board feet in this acre by 4 to get an estimate for four acres. On large areas, estimates are made by strips and the area between the strips is figured in on the same basis. For the average farm wood lot it will be advisable to cover the entire area.

Further details of measuring board feet of standing timber are not given here, for the reason that a manual will be required, showing tables, when the actual work is undertaken in the forest.

Tree Measurements for Cords

To find volume of standing trees in terms of cords, one can eliminate the board feet in the trunk of the tree as given above and roughly estimate the cords by dividing by 500 since an average of 500 board feet make a cord. Then for estimating the cordwood yield of the remainder of the trees, it can be considered that for every thousand board feet of lumber a tree contains, there will be three-fourths of a cord in the tops or limbs of hardwood trees, and one cord for pines or conifers

in general. This may be said to be a method for a rough estimate but it is sufficient for general purpose. A more elaborate method for estimating the cubic contents of trees and the limbs that can be used would require considerable time and expense.

Estimating Crossties. One can measure the height of a tree and estimate how many cuts eight feet in length will produce pieces 6 by 8 inches or other dimensions the purchaser may desire. With experience, a close estimate can be made with the eye without detail measurement.

Estimating Poles. Poles should be cut according to the specifications of the purchaser. Ordinarily, the length is from 30 to 40 feet, but some longer or shorter poles are often desired. A pole 30 feet high should be 6 1-2 to 7 1-2 inches in diameter at the top. The diameter at the base of the pole may vary from 20 to 30 inches or more. The longer the pole the greater may be the diameter at the butt.

With a little practice, one can easily approximate with the eye the length of pole a tree will produce.

Methods of Cutting Trees

Much waste of valuable wood is lost by cutting trees too high above the ground. A foot from the ground, or even lower, is a proper practice.

The length of logs should be in conformity with the demand of the market. The standard length is 16 feet, but rather than waste any part of the log, 12 foot, 10 foot or 8 foot logs may be cut at the top.

Much standing timber is sold to saw mill operators on the "stumpage" basis; that is, the mill people do the cutting. Often

the saw mill people cut small timber that should be left for further growth. They do not always fell the trees and remove the logs with proper care for prevention of damage to the young trees. Therefore, it is usually better for the owner to harvest the logs and haul them to the mill or to the railroad.

Many timber owners in Georgia are finding a market for wood or tops of trees, fallen trees, trees that are to be removed in thinning and for species of trees not fit for lumber, by selling them to paper mills. This not only provided a market for what has been considered waste materials but encourages proper forest management.

Trees can usually be harvested with greatest convenience during the fall or winter. As soon as possible the logs, poles, crossties, or cord wood should be removed from the woods to sunny, airy places, else decay or insect damage will set in and reduce their value.

Logs of large size will bring more than small logs of equal grade. Three grades of logs are recognized in some places. No. 1 are logs 10 inches and over in diameter with surface and ends clear of defects. No. 2 must not have more than three standard defects or should be only slightly wormy. No. 3 are logs falling below No. 2, being crooked, rotten, etc.

Defects that determine grade are knots, rot, fire scars, wormholes, stain and crookedness. As a rule a No. 1 grade may have two small limb knots, but two large knots make it No. 2 or cull if at each end or No. 3 grade. Defects that are removed with the slab in sawing are not considered.

It will be desirable if one is cutting logs to be converted into lumber for home use to know about how many board feet a log will produce. This is ascertained by obtaining the diameter of the log inside of the bark at its small end and using a log rule table. In Georgia the Doyle rule is legal. The table is as follows:

Diameter of log (small end, inside bark) Inches.	Length of log in feet												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Contents of log in board feet												
6	1	2	2	2	2	3	3	3	3	4	4	4	4
7	3	4	4	5	5	6	7	7	8	8	9	10	10
8	6	7	8	9	10	11	12	13	14	15	16	17	18
9	9	11	12	14	16	17	19	20	22	23	25	27	28
10	13	16	18	20	22	25	27	29	31	34	36	38	40
11	18	21	24	28	31	34	37	40	43	46	49	52	55
12	24	28	32	36	40	44	48	52	56	60	64	68	72
13	30	35	40	46	51	56	61	66	71	76	81	86	91
14	37	44	50	56	62	69	75	81	87	94	100	106	112
15	45	53	60	68	76	83	91	98	106	113	121	129	136
16	54	63	72	81	90	99	108	117	126	135	144	153	162
17	63	74	84	95	106	116	127	137	148	158	169	180	190
18	73	86	98	110	122	135	147	159	171	184	196	208	220
19	84	98	112	127	141	155	169	183	197	211	225	239	253
20	96	112	128	144	160	176	192	208	224	240	256	272	288
21	108	126	144	163	181	199	217	235	253	271	289	307	325
22	121	142	162	182	202	223	243	263	283	304	324	344	364
23	135	158	180	203	226	248	271	293	316	338	361	384	406
24	150	175	200	225	250	275	300	325	350	375	400	425	450
25	165	193	220	248	276	303	331	358	386	413	441	469	496
26	181	212	242	272	302	333	369	393	423	454	484	514	544
27	198	231	264	298	331	364	397	430	463	496	529	562	595
28	216	252	288	324	360	396	432	468	504	540	576	612	648
29	234	273	312	352	391	430	469	508	547	586	625	664	702
30	253	296	338	380	422	465	507	549	591	634	676	718	760
31	273	319	364	410	456	501	547	592	638	683	729	775	820
32	294	343	392	441	490	539	588	637	686	735	784	833	882
33	315	368	420	473	526	578	631	683	736	788	841	894	946
34	337	394	450	506	562	619	675	731	787	844	900	956	1,012
35	360	420	480	541	601	661	721	781	841	901	961	1,021	1,081
36	384	448	512	576	640	704	768	832	896	960	1,024	1,088	1,152
37	408	476	544	613	681	749	817	885	953	1,021	1,089	1,157	1,225
38	433	506	578	650	722	795	867	939	1,011	1,084	1,156	1,228	1,300
39	459	536	612	689	766	842	919	995	1,072	1,148	1,225	1,302	1,378
40	486	567	648	729	810	891	972	1,053	1,134	1,215	1,296	1,377	1,458

Marketing Forest Products

If tomorrow you had to face the responsibility of marketing your forest products, how would you go about it? You would probably want to know first the uses to which your various kinds of wood can be put. This information could be obtained free from the office of the State Forester at Atlanta by asking for a bulletin entitled "Uses of Georgia Woods." This publication very conveniently contains the names of wood manufacturers, saw mill operators and wholesale and retail lumber, millwork and log dealers, from which list you can pick the firms you think would likely be interested in your products.

In looking over the bulletin and observing the various users of woods, you may decide that some veneer manufacturing concern or some furniture company or other manufacturer would be interested in your forest products and pay a better price than a nearby saw mill. You would then write to find out what the offers would be for the species of trees and size and grade of logs that you have for sale.

In harvesting your timber some cordwood could be produced. Find out what the nearest paper mill would pay for it loaded at your nearest railroad station. It may, however, turn out that the tops and waste timber can be sold in town as firewood to best advantage.

You would also survey your land for poles and crossties production and get in touch with the market to obtain their specifications and prices.

When these steps have been taken you are then prepared to go to work with saw and axe to harvest your timber and make shipments.

All old fields abandoned for farm cropping should go back to forests. Perhaps many fields of too low producing power to make their cultivation profitable should also go back to forest. There are cut-over forest lands that are not reforesting themselves, or that may be starting growth of undesirable trees, that need reforesting. Then there is always need for tree planting along highways, in parks and on home grounds.

Two sources of reforesting supplies are available. These are the seedlings in the forest which can be replanted, and the seedlings raised in a nursery. Of the two, the latter is the better source, for nursery grown seedlings are usually stronger and better rooted and less time is required for transplanting.

Collecting Seed. When pine cones turn brown in the fall they can be gathered, placed on a canvas in the sun where they will open readily. Then the cones can be beaten to dislodge the seed. The most economical way is to gather burs from fallen tree tops. Often the seed can be beaten out of the cones on the fallen tree tops and gathered by holding a bag beneath. Pine seed should be fresh when planted on account of their rapid deterioration in germinative power.

The wings of the seed may be removed by rubbing them over a screen. A current of air will remove the chaff when the seed are tossed into the air. An electric fan can be used, and light, worthless seed may also be removed with the chaff.

Nuts or acorns may be gathered by a canvas kept under the tree.

Poplar seed should be gathered from the first of September to the last of October.

If the seed are to be kept until the spring, put the pine seed in airtight fruit jars. Ash and poplar seed may be kept in a bag in a dry, cool place. Nuts and acorns should be put

in a pit, a layer of seed being covered by a layer of dirt of equal depth until all are stored. A box may be used in a dry cellar with dirt between the layers of seed.

Seed Nursery. In a frame 4x12 feet in size, 2,000 to 4,000 pine seedlings, or 400 to 1,500 hardwood seedlings may be grown. The frame may be made of strips and wire screen, details for which are found in Bulletin No. 4 of the Georgia Forest Service, entitled "Forest Planting."

The time to plant seed is late winter and early spring, February 15 to April 30, the earlier date for South Georgia and the later date for North Georgia. Seed may be broadcast or planted in rows. It is claimed that when seeded in rows it will be easier to remove weeds.

When seed are sown they should be covered very lightly, not deeper than one-half their diameters, using sand or sandy loam for the covering.

One-half a pound of slash pine seed (8,000 to 9,000) will plant a seed bed 4x12 feet in dimensions and give about 3,500 well-developed seedlings. One and a half pound of longleaf pine seed (about 12,000) will be required for a bed 4x12 feet which would give 1,500 to 3,000 seedlings. One-half a pound of loblolly pine seed (10,000) will sow a bed 4x12 feet and produce 2,500 to 3,500 seedlings. About one-third of a pound of ash seed, one-half a pound of yellow poplar seed and one-half to a pound of acorns will seed a bed 4x12 feet.

Pine seed may be planted in rows six inches apart with half inch spacing in the row. Hardwood seed, as a rule, should be planted in rows about ten inches apart with one to one and a half inches between seed in the row.

The beds should be kept moist but not wet until the seed germinate and then watered occasionally to keep the soil from becoming too dry.

The better time for putting out seedlings in the field or forest is in the late winter or early spring though some planting is done in the fall. Seedlings started by planting seed in the spring can be transplanted the next winter or spring. If seedlings are carried over to the second year before they are planted, it is better to transplant them to spaces three inches apart in rows wider than they were in the nursery.

When seedlings are taken from the nursery they should be handled carefully to preserve their root systems. They should be placed in buckets of water or carried in wet sacks to the field for replanting. One can plow two furrows to make a planting bed, or merely dig up the ground at intervals and set out the seedlings in the soft soil, putting them a little deeper in the soil than they were in the nursery. The planting holes should be deep enough and wide enough to accommodate the roots without crowding. Do not prune off roots or any of the tops of year-old seedlings. If any roots are broken, however, prune them off.

Plant pines 6 to 8 feet apart in rows 6 to 8 feet apart. Hardwoods may be planted in rows 8 to 10 feet apart and 8 to 10 feet apart in the row.

Give the seedlings a chance to grow by keeping fires out of the fields, or animals that may tramp on or graze on them.

Usually there is spare time on the farm for gathering forest seed, conducting a seed nursery and planting some trees each year. When this is not practical, seedlings may be obtained from the state nursery conducted by the State College of Agriculture at Athens, Ga., or from commercial tree nurseries.

Shade and Ornamental Planting

When planting trees for roadsides and parks the tendency is to put out trees several years old and to prune off all limbs.

Most of such plantings die. The trees as a rule are too large when transplanted and, in the second place, the pruning is too heavy, these two together causing too great a shock to the tree.

Much better results are obtained with small trees. Conifers, which include pine and cedar, should not be planted when over a year or two old. However, white pine is an exception to this rule and can be two or three years old.

Oaks, walnuts and other hardwoods having long tap roots should not be over a year old, or the seed may be planted in the place the tree is to be grown.

Broadleaf evergreens like magnolias and live oaks, should be quite small, better results being obtained when they are only about a foot high when planted.

Water oak, dogwood and other trees with many fibrous roots can be planted with success any size up to ten feet high.

Detailed information about shade tree planting may be obtained free by writing the Georgia Forest Service.

Miscellaneous Forest Products

Mention has been made of marketing trees for lumber, cordwood, poles and crossties. In addition, the forest owner should study the uses to which his woods may be put and find out whether there are opportunities for selling to producers of veneer and excelsior. If a market is provided by cooperage concerns, chair makers, crate manufacturers or for mine timbers, the length of the cuts will be shorter than for lumber.

Forest By-Products. An owner of a forest will not utilize his resources to the greatest advantage unless he makes use of any market he can supply for several by-products. He might find a desirable market for charcoal which he could produce on the place.

In hardwood areas there may be black walnuts, hickories

or other nuts that might be sold to advantage. An increasingly important market for tree seed to be used for reforesting is developing. An industry of considerable importance in some areas is the sale of chestnut wood to tanneries. The bark of hemlock and chestnut oak is marketed in the same way.

Huckleberries, or blueberries, are in demand for food. These grow in the forests throughout the state and are easily gathered and canned if they can be marketed better in that form. Many roots and herbs used in producing medicines may be found in Georgia forests. A little effort in learning to identify these and in finding buyers will often be worth while. The same may be said of edible mushrooms which grow profusely in parts of the state.

The longleaf pine needles, as has been mentioned, are being used for making baskets, ornamental holders and art objects. They are also used for making charcoal.

The making of rustic and porch furniture may appeal to some forest owners as an enjoyable pastime and is usually quite profitable. Cedar, hickory, ash and other hardwoods lend themselves to these products, and white oak is used for splints to make baskets and the seats of chairs. Some forest owners may choose to make billets for bats, spindles or golf clubs and so on.

Many Southern forests have shapely young cedars and pines that can be obtained by thinning excessive stands and marketed at fancy prices for Christmas trees. Holly trees may be deprived of some of their limbs for Christmas greens. In the mountains are evergreen galax leaves for holiday and florist trade.

In a word, the alert person can find many by-products of the forest areas of Georgia.

Organized Fire Protection

On account of the great loss to the nation caused by forest fires, the national government by the Clark-McNary Act appropriates funds to the various states to help prevent and control forest fires.

In Georgia, land owners are organized into timber protective organizations, the object being to get land owners with adjoining properties to form these organizations and co-operate in employing modern protective methods. The fire hazard being largest in the pine belt of South Georgia, naturally the timber protective movement has gained greatest headway in that region. Units of 15,000 to 300,000 acres each have been formed with fire observation towers made of steel and standing 80 to 110 feet high. When the lookout man sees smoke at any point in the area, patrolmen, fire fighters and helpers hurry to the place to put out the fire.

To help hold fires in check, firebreaks are constructed throughout the forests. A firebreak consists of a strip from which trees are removed, furrows plowed on either side of the strip and the area in the strip burned clean. These usually check the spread of the flames. In hardwood areas of North Georgia, trails through the forest are swept clean of leaves to check fires and furrows are plowed around the borders.

The land owners pay the expenses of protecting the organized forest areas and the government repays them for a part of what they expend. The timber protective organizations have been able to very effectively keep down fires at an initial cost of about 8 cents an acre, which includes the cost of constructing fire towers. Of course, the cost of subsequent years would be much lower.

Any group of farmers who co-operate in creating a unit of 10,000 or more acres and employing methods of fire protection recommended by the State Forester can obtain government aid.

National Forests

The Federal government under the Week's Act, has the power to buy forest lands, protect and manage them. This does not deprive the country of the use of wood grown on the national forests, but the timber is cropped and sold in keeping with good forestry practice. Under a Georgia law, national forest lands can be acquired only in North Georgia.

Large national forest areas are held in the mountains of North Georgia. The name and area of each national forest in Georgia are as follows:

Cherokee National Forest	109,743 acres
Nantahala National Forest	97,316 acres
Total	207,059 acres

State Forest-Parks

Georgia is acquiring state forest-parks. The two first forest-parks acquired are Vogel Forest-Park at Neel Gap on Blood Mountain, and Indian Springs, near Jackson, Georgia, in Butts County.

Vogel Forest-Park is a picturesque area, visited by tourists from all parts of the world. This park was donated to the state by Honorable Fred Vogel, Jr., of Milwaukee, Wisconsin. For this park a lookout fire tower to be located on Blood Mountain near the highway at Neel Gap is to be erected by members of the American Legion of Georgia. This tower is to be made of stone and will stand a perpetual monument to Georgians who fought in the World War.

The Indian Springs property, long famous as a health resort, was converted into a state forest-park and is now being controlled by the Georgia Forest Service.

Other offers of picturesque or historical places are being considered for state forest-parks.

Suggestions

Cruise standing timber for estimates of board feet and cord wood. Note ratio of lumber to cordwood in pines; in hardwoods.

Conduct tree nursery.

Reforest old fields with plantings.

Make tests of different woods of trees to note ability to take polish.

Construct fire breaks.

Visit a saw mill and study defects of logs. Grade accordingly.

Measure the contents of logs.

Measure the board feet of lumber contained in the logs.

If possible to obtain equipment, creosote some fence posts.

May, 1929 Bulletin 8

Georgia Forest Service

B. M. LUFBURROW, *State Forester*

The Cellulose Industries

By

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Cellulose Industries As a Field For Georgia Capital

By

W. W. ASHE

The Cellulose Industries

By B. M. Lufburrow

When the verbose walrus spoke

> "Of shoes and ships and sealing wax,
> Of cabbages and kings,"

he might have added to the gamut of contrasts—

> "Of silk and alcohol, of ivory and glass,
> Of photographic films and smokeless powder,
> Of paints and pails and paper."

All the latter are largely forms of cellulose or cellulose compounds. To name only the most important chemical cellulose products, there is artificial silk or rayon, flexible glass or cellophane, collodion and celluloid; artificial amber, tortoise-shell and ivory, photographic films, paints, lacquers and enamels, gun cotton, high explosives and smokeless powders, indurated ware and vulcanized fibre, paper of all kinds, and wood or methyl alcohol.

The name cellulose is derived from the cellular structure of plants. Plants are built up of minute, mostly elongated boxes or tubes, the *cells*. The framework or skeleton of the walls of these cells is called cellulose. In all parts of the world cellulose forms a large proportion of the bulk of most trees and plants. Whether it be the dwarf birches and willows within the Arctic Circle under the colored lights of the aurora borealis, or the stately palms of the tropics, their evergreen fronds bathed in the sunlight of eternal summer, the framework of all is cellulose.

Cellulose in one of its myriad cellular forms is thus universal in its distribution, and few parts of the earth lack a suf-

ficient supply in the form of trees or plants not to justify the establishment of factories for its industrial use. Wood is largely cellulose, but in an impure form. Cotton fibre, the white fluffy lint of Dixieland, is essentially a pure natural cellulose. Esparto, a grass grown in the Mediterranean countries, is extensively used in Western Europe as a commercial source of cellulose. The bamboos of Asia are likewise a valuable source, and even corn stalks are available when they can be assembled cheaply enough. An enormous amount of cellulose yearly goes to waste in cotton stalks. Grain straws are largely cellulose, but they contain a high proportion of silica, a flinty, sand-like mineral, which is objectionable. Wood pulp furnishes not less than 95 per cent of the cellulose for industrial chemical purposes and the proportion from this source increases every year as greater progress is made in methods of handling it. Although cellulose is not a food, it forms a part of all grains and fruits and a large part of all hay and vegetables, constituting what the dietitians call crude fibre, indigestible material, but furnishing the food bulk needed for proper health.

In wood the walls of the cells are stiffened by the deposit of cellulose or by the conversion of cellulose into the related chemical compound lignin, with cellulose embedded in the lignin. Lignin forms the center of the cell wall, or the middle lamella, which is the first portion of the cell formed from the protoplasm. This strata of lignin separates one cell from the adjoining cells. Its function is assumed to be purely physical. It produces an increase in the hardness or lignification (woodiness) of the cell wall and a resistence to swelling with water. Lignification, which is the conversion of the cellulose of the cell to lignin, ceases when growth of the cell is complete. The pentosans also form a large proportion of the wood tissue, and like lignin they seem to have no physiological function, such as storing up reserved food or supply materials, but serve as a cement to hold the fibres together.

There are other secondary components of the woody tissue such as tannins, starch, fats and resins which are within

the cells. These it is necessary to remove before the cellulose of wood is in that state of purity which permits its uses where exact chemical reaction must be provided for. In cellulose chemistry pentosans and lignin are usually referred to as beta and gamma cellulose and the real cellulose as alpha cellulose.

The process of pulping, when reduced to its simplest terms, is based upon the use of chemicals which will dissolve the lignin and pentosans (gamma and beta cellulose) and leave the cellulose fibres in the form of loose bundles. The lignin and pentosans are separated out by hydrolysis or oxidation of cellulose. Lignin and pentosan are rather terms of physiological botany. The cellulose chemist considers the woody tissue in relation to its reaction to certain chemicals. That portion of the cellulose fibre undissolved by a 17.5 per cent solution of sodium hydroxide represents alpha cellulose, which is the cellulose of commerce. Pentosan and lignin are the chief constituents removed as a result of such treatment. If this mixture of pentosans and lignin is then heated with a 5 per cent solution of acetic acid, the beta cellulose is precipitated out. The portion remaining is the gamma cellulose of the chemist.

When carefully manipulated, cotton will yield cellulose which has well defined properties containing few impurities. For this reason it is the cellulose which is generally accepted as the standard. Wood cellulose, irrespective of the species of tree from which derived, cannot be isolated in such a state of purity. Consequently, wood cellulose is not as homogeneous as that derived from cotton. Wood cellulose also varies in its composition and purity according to the methods employed in its isolation. So much so that some investigators have regarded wood cellulose as being of different chemical composition from cotton cellulose. But Bodeker and a number of other cellulose chemists regard them as being identical when wood cellulose is thoroughly purified, although investigations along this line are not yet complete.

The difficulty of determining the exact chemical nature of cellulose is due largely to its collodial properties and to the most intimate association of other more or less related compounds of plant structure which have not yet been successfully eliminated so as to procure absolutely pure cellulose. Chemically, cellulose is close to starch and like starch, it is nitrogen free, although it is produced by protoplasm which is a nitrogenous substance of the living cell. From the point of view of present uses and possibilities, and on account of its wide distribution, cellulose is commercially the most valuable constituent of plant life, outside of the strictly food compounds like starch.

Unlike many organic compounds, cellulose combines with many chemical reagents and can later be recovered from them in its original form of cellulose—Resurgit! "Regenerated." Yet, notwithstanding its resistance in the laboratory to certain classes of chemical action, in nature it readily and most fortunately succumbs to the bacterial ferments and the attacks of lower forms of plant life. The cellulose in the leaves and fallen trunks of trees after passing through the stage of humus, which is the brown or blackish layer lying immediately beneath the fallen leaves or moss in every unburned woods, is eventually reduced by the further action of these organisms to the stable forms of water and carbon dioxide from which it was originally built up. Earth to earth; carbon dioxide to carbon dioxide. There was a period, however, in our geological history, while our coal deposits were being formed by the accumulated stems of trees, when this decay proceeded far more slowly than at present.

Rayon of Wood Silk

Rayon is the spruce tree silk. Its manufacture dates back only about two decades, yet today as a textile material it is surpassed only by cotton and wool. It already outranks both silk and linen. It is adapted to the manufacture of a wide range of woven and knit goods. It has a high luster, or can

be made with slight luster or even with a dull finish if desired. It can be used alone or in mixture with cotton, wool, silk or any two of them. It takes dyes well, and as a substitute for silk has the advantage for many uses in being free from the attacks of moths.

The original process for making cellulose yarn was developed in France. What is known as the viscose process was developed in Great Britain by the industrial chemists Cross and Bevans. The latter is the more widely employed process. A large amount of cotton linters is employed in the manufacture of rayon but purified wood pulp is also extensively used.

For making rayon, cellulose that is largely free of all non-cellulose compounds, such as starches, resins, lignin, and pentose, is treated with reagents to convert it into a gelatinous mass. The most widely used gelatinizing agent is carbon bisulphide, the employment of which is known as the viscose process; ammoniacal copper oxide may be used as the solvent; or, as in the original Chardonnet process, it may be a low nitrate solution, the threads subsequently being denitrated. The jelly which results from the action of these agents is forced through minute holes which are drilled perfectly round. The fine threads thus formed emerge into a solution which causes the jelly to coagulate or solidify, and in so doing to revert to the original cellulose. In another process, the cellulose treated with acetic acid compound becomes and remains an acetate of cellulose. The fine threads, as they are drawn through the hardening bath, represent only the first stage in the production of rayon. It is subjected to many other processes before it is eventually placed upon the shop counters as the strong but silky material of commerce.

The thread of yarn which is used in woven or knit goods is not a single solid filament. It consists of a number of fine strands which are twisted together, the number varying with the size of the yarn.

But viscose has a wide range of uses other than for textiles. It is formed into the thin transparent sheets known as cellophane and into viscose caps which are being made on a large scale. Viscoid is made from viscose, being imitation horsehair for upholstery and artificial wool, the thread being formed with a minute hole in its center like miniature macaroni. Among other extensive uses are as a filler in connection with the dyeing, printing and finish applied to textile fabrics; as a sizing material for laid papers; as a filler and surfacing material of cloth for binding books; and as a covering for waterproof and washable window shades.

Paper and Cellulose

The largest use of elaborated cellulose is for paper. Its employment, however, for this purpose, is less spectacular than its use for rayon; less of the marvelous to it than the making of a flexible glass from an opaque brittle base; less wonderful than the production of highly dangerous explosives, for paints and ivory, all from the same material which has served for the fuels of mankind since Prometheus snatched fire from heaven and man smothered his terror sufficiently to employ it as a beneficial agent. But cheap paper, abundant cheap paper, has been one of the most important factors in the development of modern civilization.

The total world-wide production of paper is in excess of fifteen million tons, having an aggregate value in excess of $800,000,000 a year. The ranking producing countries are the United States, which makes more than half of the total world's output, and Canada, the United Kingdom and Germany, which together produce one-fourth. The remaining one-fourth is scattered among all the countries of the world.

There are two classes of paper. Those which are made of commercially pure cellulose, the result of chemical treatment of wood, esparto, cotton, rags, straw and bamboo; and those, such

as newspaper stocks, which consist in part of ground wood without preliminary treatment, merely screened and blocked.

Newsprint paper contains only from fifteen to twenty per cent chemical pulp, that is, pure cellulose fibre. While the bleached ground wood is largely cellulose, it is associated with other compounds which go to make up wood tissue. Newsprint is made largely of merely ground wood, while bleached chemical pulp, essentially pure cellulose from which impurities or associated compounds have been eliminated by chemical treatment, might be said to form the entire body of some other papers. This chemical pulp is suitable not only for making paper, but after purification, for making rayon, flexible glass, high explosives, paints, or other cellulose compounds.

Kraft paper, however, for the making of which the wood of the yellow pine is used, is not a pure cellulose material as is the case with the other papers which are made from chemically prepared pulp. Kraft paper is made from an uncooked pulp, digested with sodium sulphate and sulphide liquor, and disintegration of the fibres, in place of being due to prolonged chemical treatment, is completed in the beaters and the Jordan engines. In the present day process for making Kraft paper, most of the turpentine is removed from the chipped wood by steaming before chemical treatment. Several valuable by-products are obtained through the recovery of methyl alcohol, oil of turpentine and various resins. Kraft papers, which are the brown wrapping papers, are characterized by their toughness.

There has been wonderful improvement in the methods of making these papers during the last decade. Formerly, it was customary to saponify the resins in wood of pines used in making this class of paper, to render them soluble so they could be washed out. The cost of chemicals used in this process was high and the resins were lost. Even with the most improved processes for making paper, large amounts of chemicals are required. For converting spruce wood into white paper about

1,300 pounds of coal, 230 pounds of sulphur and 300 pounds of limestone are required to produce one ton of dry pulp from about two tons of dry and prepared wood. A cord of dry spruce wood weighs about 3,100 pounds, or about one and one-half tons. Yellow pine wood is much heavier. The weight of the wood of the broad-leaved trees varies widely, some being quite light, even lighter than spruce, while other kinds are far heavier than even the wood of the yellow pine.

Of the several chemical processes in use for separating cellulose from other compounds that form wood, the sulphite process is most generally employed, more than two-thirds of the world's output of pulp for paper and rayon being so produced. By this process wood chips chiefly of spruce or northern poplars (aspen) are digested or cooked in closed retorts with hot bisulphite of lime which is prepared at the pulp mill in a special plant known as the acid plant. This liquor dissolves all the constituents of the wood except the cellulose, which is resistant, and these dissolved constituents are washed out, leaving the pulp as an impure, unbleached cellulose, which when bleached, becomes pure chemical cellulose. A cord of spruce wood yields by this process about 1150 pounds of pulp, so that it might be said that half of the wood used is saved as cellulose. The other half of the wood, consisting of lignin, pectins (pentosans), etc., known as beta and gamma cellulose, is now entirely a waste product.

The qualities which determine the value of wood for paper making are primarily length of the fibre after chemical treatment, ease with which the wood when subjected to chemical treatment or ground, can be disintegrated into separate fibre; the readiness with which it can be bleached; the proportion of fibre, or pulp, as the treated wood is called, which is obtained; and its felting qualities. An essential element in paper making is the felting or knitting of the fibre or strands on being deposited from water—the strands must interlock just as in a felt hat.

On account of the evenness of the texture of spruce, its large proportion of true cellulose fibre (more than 50 per cent), the length of its fibre (from three to four millimeters), ease of bleaching, low loss in digesting with chemicals, and small resin content, this tree provides ideal wood for paper making, especially ground pulp for newsprint stock. Sulphite cellulose pulp fibre made from spruce is the standard.

It may therefore be said that no other wood is in the same class as spruce or can compete with it for the production of newsprint paper. Every year newspapers absorb an increasingly large proportion of the total output of paper and as the demands for suitable paper pulp increases, every available source of supply is scanned and appraised. But in producing rayon the fibre is destroyed in the process of gelatinization; therefore, cellulose from any other source is equally serviceable if it can be produced as cheaply and with the same standard of purity.

Pines have very long fibre but their wood is not as uniform in texture or color as spruce. Dense, dark brown rings of wood alternate with soft, less dense, pale brown or yellow rings. This necessitates chemical treatment to separate the fibres. It is difficult to bleach the dark brown wood. In addition, the wood of the pines contains varying amounts of resin which must be eliminated to produce any but lowest grade paper. The proportion of wood eventually available for white paper making is relatively far smaller than in the case of spruce, and the processes of converting it are far more costly.

The wood of many hardwoods, especially the heartwood, which is usually of a yellow or brown color, is dififcult to bleach; the fibre is short and much of it is so light that it floats off in the process of washing or is otherwise lost in the necessary chemical treatment. The bamboos of eastern and southern Asia offer an unlimited amount of fibre similar in many respects to that of yellow pines and are well suited for the manufacture of Kraft papers, now that the objectionable dark coloring of their pulp can be avoided through the removal of cer-

tain ingredients which in process of normal chemical treatment were burned a dark brown color. Methods also have been found to obviate the necessity of cutting out the knots or joints in their stems.

The advent of wood into the paper field dates only from the third quarter of the last century. Since then the processes have step by step been improved or replaced by better. Accompanying the improvement in manufacture and cheapening of cost, there has been an enormous increase in the use of paper, particularly newsprint. Whereas population has trebled in the last fifty years, the use of paper in the United States has increased seven times. How far will this mounting increase extend?

Special Cellulose Industries

Paper and the textile rayon are essentially pure cellulose, an exception being the trade brand known as celanese which is a compound of cellulose and acetic acid or wood vinegar.

A number of special cellulose industries depend not upon specific chemical or physical properties of unaltered cellulose, but upon the properties of its derivatives or its compounds, such as its esters. The esters are etherial salts, that is, combinations with either organic or inorganic acids, cellulose behaving as an alcohol in chemical reactions. The chief property of these compounds is their solubility in various alcohol solvents, notably in ether-alcohol.

The two important chemical esters are the nitrates and the acetates. Nitrates which are characterized by inflammability are formed by the action of nitric acid upon cellulose, there being a series of nitrates obtained by varying the length of the period of the action of the acid. They are the basis of collodion, of celluloid, of the nitrates employed in the production of artificial silk by the Chardonnet process, and in making high explosives. The explosive propensity or inflammability is

increased by prolonging the action of the nitric acid, which increases the proportion of the nitric acid component.

The acetates of cellulose are parallel materials to the nitrates with closely similar properties, but less inflammable. The chief bar to their wider adoption has been their price, but developments in methods of handling the acetylation reaction so as to recover the acetate values remaining in the reaction mixtures, have resulted in greatly cheapening costs. They are now being generally employed in making a rayon textile, in paints, in photographic films, and for other purposes.

Photographic and Movie Films

The first flexible photographic plates were made of collodion on which gelatin emulsion was spread which was then photo sensitized. The cellulose film was a decided improvement since it permitted the film to be rolled. The early cellulose films, however, were made of highly inflammable cellulose nitrates. They were dangerous and there was risk in using them in commercial moving pictures. Another defect which users of rolled films will remember in the first decade of the present century, was the manner in which the films curled up after being developed. This made it extremely difficult to handle them. Often after they became old they were extremely brittle and would frequently tear or break. This trouble which was due to greater tension on one side of the film than the other as a result of the coating, was overcome.

Next, the cellulose acetate film was substituted for the pyroxylin. This greatly reduced danger from inflammability. The troubles with the acetate films were their stiffness and brittleness, also their high cost. It was some time before the problem of stiffness was solved. Now acetate films are coming into general and standard use. Their durability, greater flexibility and lower cost, have made them commercially acceptable.

Hygienic Sausage Casings

Another use for sheet cellulose is in making casings for stuffed sausage. Sausages put up in this material are sold as skinless, the casing being so thin that it is scarcely noticed when the sausage is eaten. When browned by cooking the skin becomes fragile and tender. These casings are made of a cellulose film which is less than one-thousandth of an inch in thickness. Now that the wiener skin can be made of sanitary cellulose, we may look for the "hot-dog" stands to reach a higher sanitary standard.

Trunks and Smokeless Powders

Vulcanized fibre is a trade name for a composition board made from heavy paper or paper boards treated with zinc chloride solvents, the sheets being cemented together by means of the solvent which is afterwards washed out. Vulcanized fibre is used for making trunks, packing cases for traveling men, hat boxes, washers for faucets and for electrical insulation. Articles like pails, waste baskets, etc., can be pressed into shape in a single piece, this adding materially to their strength and durability.

If cotton as a textile material has been among the foremost products of the world in ministering to the comfort of mankind, it likewise, as the foundation for gun cotton and smokeless powders, has been one of the important instruments in destroying civilization so slowly built up. Gun cotton, made by treating purified cotton with nitric acid, is a dangerous form of cellulose to handle, but it was discovered that it could be dissolved in alcohol compounds or ethers, with which it formed a jelly. While in the jelly stage it can be moulded or cut into shapes and sizes required for use as an explosive. After the evaporation of the solvent it then again becomes a solid, retaining its shape, and is more easily handled than in the form of gun cotton. Also, while in the jelly stage it is less explosive

than while in the dry form. This material is combined with nitro glycerine forming the base of a number of smokeless powders having somewhat different properties, but each with a nitro-cellulose component.

It is stated that the surplus stock of nitro-cellulose left on the hands of manufacturers of war explosives was largely responsible for the development of the pyroxylin or nitro-cellulose paints. Nitro-cellulose compounds, as stated, were originally prepared for making smokeless powders and other wartime propellants, but when there was no longer a call for them after the World War, these enormous stocks were a source of danger. It was necessary to find some profitable use to which they could be converted. The outcome was the development of cellulose paints, which was done by modifying the nitric acid content so as to reduce inflammability and by the incorporation of paint pigments. The difficulty of applying this material was overcome by spraying in place of spreading with brushes. The use of these paints greatly reduced the time required for painting automobiles. Even the tin "Lizzie" required a certain amount of luster to sell it. Two coats of oil paint require several days in the paint shop, but with the pyroxylin paints, four coats can be applied within as many hours.

Through the admixture of castor oil, these pyroxylin compounds remain plyant upon drying. This permitted cloth to be waterproofed by a coating of them, or the cloth could even be built up in thickness and grained in imitation of leather. Such cloth is used for covering automobiles, and for covering trunks and bags, while the imitation leather is extensively used in upholstery. Specially prepared cloth is similarly coated for window shades, while still other kinds serve as covering for backs of books, or in place of wall paper for bathrooms or where a washable wall covering is desired.

Ivory and Pearls

Celluloid was developed as a cellulose compound about the

middle of the last century. When its commercial manufacture had been cheapened, there was an era of the celluloid collar and cuffs—indestructible apparel—designed to reduce the laundryman to penury and outwit the haberdashery makers of Troy. Mais, c'est a rire! The table is turned, for rayon cellulose has now been adopted by the shirt making fraternity as a seductive material for a silk craving male; and as the hick of the burlesque stage was supposed to ablute his celluloid clothes over the tin pan on the back porch, so now our Cinderella nightly cleanses at least her wood-cellulose hose in the home lavatory, dries them on her private clothes line and is the princess in them the next day.

Cellulose might be considered as the earliest of the pyroxylin plastics. From it there has been gradually developed an enormous industry manufacturing articles from a composition produced by a mixture of nitro-cellulose, camphor and alcohol. These compounds form the artificial ivories, the imitation amber, imitation shells and pearls and are employed for making a wide and wonderfully beautiful range of toilet articles of infinite shades, opaque or translucent, dull or brilliant, to meet the demands of style or the whims of fancy. Among some of the articles which are made may be mentioned umbrella handles, bag frames, toilet sets, bracelets, necklaces, imitation stones for breast pins, ear rings, buttons, fountain pens, optical frames and knife handles. And when noting the varied array of these beautiful articles in the display case of a store, consider that their base may be Georgia cotton elaborated through the knowledge of the chemist and wrought into a form designed by an artist.

Wood Alcohol

And then there is methyl alcohol, so often referred to in the newspapers, and familiarly known as wood alcohol, its imbibers becoming—like cupid and like even-handed justice—sightless. A most valuable industrial product with a range of

industrial uses, it is fortunately referred to as an alcohol rather than by its chemical cognomen of methyl, for if it were not sold as an alcohol, its employment in a poisonous, if not fatally blinding beverage, would be less frequent. It is a distillate of the cellulose of wood, the chief other product being acetate of lime (acetic acid) which, combined with cellulose as its acetate, forms one of the most valuable of the cellulose esters.

Who Owns the Cellulose Industries

Plants for the manufacture of rayon are built in large and expensive units. Those in the United States are largely controlled by American capital operating, however, under foreign-owned patents. But considerable foreign capital is also invested in American rayon factories. The Hercules Powder Company, duPonts and other makers of high explosives are interested in cellulose for such products as have a nitro-cellulose base, but the duPonts especially have widely ramifying interests in other lines of manufacture, particularly paints, celophane and pyraline or imitation ivory, which make extensive use of this compound.

As having a bearing upon the subject of the ownership and control of the world wide rayon industry, the following is quoted, with slight changes, from a recent report on the subject, "International Cartels," issued by the Department of Commerce, June, 1928:

"The so-called international rayon cartel is, strictly speaking, not a formal cartel, at least, the information so far revealed does not indicate a specific understanding regarding limitation of production, although there is a very definite agreement or 'convention' on prices. The declared object of the cartel is to eliminate harmful competition through an agreement on prices and a certain specialization in marketing, without a definite territorial division, and an improvement of the product through interchange of patents and technical improvements and processes.

This is further strengthened by the rather close financial interrelation between members, extending in some cases to joint ownership of plants and in others to practical control. This feature, combined with the fact that the two most important members of the combination, Courtaulds and the Vereinigte Glanzstoff, have branch plants or closely affiliated plants, in the important consuming markets of the world, would account for the fact that this apparently loose international organization is, with some justice, regarded as coming closer to an international trust than any other known international cartel.

"The rayon industry has had an international character from the time it emerged from the experimental stage. This was due not only to the patent factor, which is of extreme importance, but also to the fact that the manufacture requires large amounts of capital for experimental work, as well as for the actual production. It is a very mobile industry from the raw material standpoint and the distribution of plants has been largely determined by the initiative of capital, consuming capacity of market, tariff policies, and availability of labor.

"Although the so-called working agreement between the largest producers—Courtaulds (Great Britain), Vereinigte Glanzstoff (Germany), and Snia Viscosa (Italy)—was concluded at the beginning of 1927, an agreement between the first two groups dates at least from 1925, as evidenced by the organization of the Courtaulds-Glanzstoff plant near Cologne; the establishment of close relations with the largest Dutch producer, Enka, also preceded the larger combination. The unusually rapid progress of the Snia Viscosa, due to a considerable extent to the favorable labor factor, was arrested toward the end of 1926 by the Italian currency situation and other financial difficulties, which gave the British and German groups an opportunity to acquire sufficient holdings in the Italian concern to assure its entry into the combination. It is claimed by some that the control of the Snia is now in the hands of the Courtaulds-Glanzstoff pool. The consolidation of the French

producers during the second half of 1927 marked the rise of another strong competitor, with the result that at present there is in existence a working agreement on prices, domestic markets, patents and technical processes and improvements, affecting between 80 and 90 per cent of the world rayon production.

"A number of factors in the rayon situation need pointing out to indicate the full significance of the concentration movement. In the first place, the international working agreement affects primarily the production of rayon by the viscose process, comprising 80 to 90 per cent of world production. The most important producers of acetate rayon, like British celanese, are not members of the combination, although the Vereinigte Glanzstoff is also interested in the production of acetate rayon, in combination with the I. G. Farbeinindustrie, through joint ownership of the Aceta plant; and it is claimed by some that the partial adherence of the Belgian Tubize interests and the relations between the Verinigte Glanzstoff and the I. G. Farbeinindustrie bring the viscose combination rather close to the important non-viscose producers.

"There is one feature about the international rayon agreement that is of particular interest to the student of the industrial development of the United States. The rayon industry represents the striking anomaly of an American industry producing more and consuming more of a staple manufactured product than any other country in the world, that is either affiliated with or controlled by foreign interests, that is, by Courtaulds (Great Britain) and Vereinigte Glanzstoff-Bemberg (Germany), and leading members of the international combination. This condition is explained primarily by the fact that the basic patents of the industry are largely of European origin and that the European producer displayed considerable initiative and enterprise in taking advantage of the possibilities of the American market.

"Another important point is that the headquarters of the most important members of the international group are located to a considerable extent outside of the countries in which they have their principal plants. The interests of the Courtaulds in the United States, for instance, are vested in its subsidiary, the American Viscose Corporation, which is responsible for about 55 per cent of the country's total production; and operations in Canada, India, Spain, Norway, Germany, France, Czecho-Slovakia, etc., are more important collectively from a production standpoint, than this concern's plants in England.

"Although the foreign interests of the German group (Vereinigte Glanzstoff) are less extensive, this concern is interested in important plants in the United States, Japan, Austria, Czecho-Slovakia, and the Netherlands, in addition to having financial interests in the J. P. Bamberg A. G., the second largest producer in Germany, which also has some foreign branches. The same situation exists to some extent with Italian and French producers.

"It will therefore be seen that the rayon combination is a world combination, one of the most comprehensive as to the proportion of production controlled, as well as one of the most intimate from a financial standpoint, considering the number of countries involved.

"Considering that this degree of centralization has been attained by an industry whose total production in 1896 amounted to only 600 metric tons, as compared with 120,000 tons estimated in 1927, there is some justification for the statement that the international rayon cartel, in spite of the exceptional nature of the rayon industry which makes it particularly adapted to international combinations, cannot be regarded merely as an exceptional development, but rather as a striking manifestation of the movement toward centralization characteristic of modern industry."

CELLULOSE INDUSTRIES AS A FIELD FOR GEORGIA CAPITAL

By W. W. Ashe

The State of Georgia is rich in cellulose yielding materials but the amount of chemically elaborated cellulose made in the state is small.

In Georgia the most important raw cellulose material is cotton. Low-grade cotton forms the basis of an enormous number of cellulose articles. Nevertheless, there are in Georgia only a few plants engaged or preparing to engage in the elaboration of cellulose from cotton. Of these, the most important are the nitro-explosive plant at Brunswick and the rayon plant at Rome.

An unlimited and, so far as the State of Georgia is concerned, a practically untouched cellulose field is the native woods. The wood of all the native pines is about 45 per cent cellulose. The pines are distributed over the whole of Georgia. On the slopes of the mountains grows the white pine, and at lower altitudes the yellow pines extend over the state to the coast. Many broad-leaved trees likewise might be made sources of cellulose, such as yellow poplar, which is found throughout the state, and the bays and gums which form a large portion of the timber of the swamps of the eastern and southern counties.

Although cotton has been the backbone of southern prosperity, there is throughout its realm no laboratory or chair at any institution devoted to extending the use of cotton through chemical research. If today there is an enlarged market for cotton linters as a result of the manufacture of rayon, this widened field is due to no process developed by the initiative of cotton interests.

Need of Research

To develop adequately the cellulose chemical industries, research work must be established and maintained. This will provide facilities not only for placing before the engineers and chemists complete information in regard to commercial processes but for testing out and developing new processes. Such research could go far toward establishing cellulose industries in the state. This would open up new and profitable channels for the marketing of Georgia wood and assist in rehabilitating the declining agriculture of the state.

Wood, which is the chief source of the cellulose for the chemical industries, is largely composed of three series of compounds referred to by the industrial chemist as alpha, beta and gamma cellulose. Alpha cellulose is the cellulose of commerce. It forms for different kinds of trees from 40 to 60 per cent of the weight of their wood. Under the processes that are in current use the other cellulose materials in wood have little value and are wholly or in part wasted. The development of a process permitting profitable use of beta and gamma cellulose might add much to the value of the woods of the southern pines, which carry an exceptionally large proportion of the materials. Such a development might result in making the yellow pines of Georgia equally valuable with spruce as a source of commercial cellulose for many purposes. This would mean a material increase in the wealth of the State of Georgia.

Another wide field open to the chemist is the development of processes that will permit a more extensive use of the woods of Georgia in the manufacture of paper. The paper-making qualities of many of these woods are little known. Less than three decades ago it was held doubtful whether the wood of the Southern yellow pines, on account of its hardness, its deep yellow color which rendered bleaching costly, and its resinous nature, could be successfully employed in making any but the coarsest paper. Today this wood is a standard and economic material for making many classes of strong papers; but these

papers are brown, and this restricts their field of usefulness. Wider use will depend upon the chemist.

The Land Problem of Georgia

The decline in rural population and agriculture that is now taking place in Georgia is taking place in other states as well; but its effects are especially acute in Georgia for the reason that far more than half of the wealth of the state is invested in agriculture. In states like New York, Pennsylvania, Ohio and Illinois, while the quantity of farm products is extremely large, the proportion of wealth produced in other lines is such that agriculture is overshadowed. To wipe out the agricultural resources of Georgia would bankrupt the state.

In the 15-year period between 1909 and 1924, population decreased in 54 out of the 161 counties in Georgia, or in 30 per cent of all the counties in the state. The counties in which the decrease took place were agricultural counties. In 28 other counties there was a decrease in rural population which was offset by an increase in the urban population, that is, in the population of incorporated towns. Thus the rural population decreased in a total of 46 per cent of the counties of the state. In those 5 years the total rural population of Georgia made the very small increase of 4.7 per cent. This low rate of increase in the rural population was partially compensated by an increase of 35 per cent in the urban population; the increase in the total population, however, was only 11 per cent. The urban industrial development of the state had not been sufficient to absorb fully that portion of the population which was lost by the decline in agriculture.

This decline in rural population, while possibly not so acute at present as during the first two decades of this century, has not yet ceased. As might be expected, the decrease in rural population has been accompanied by an alarming curtailment in the rate of agricultural development, the real founda-

tion of the prosperity of the state. Increased efficiency on the part of the remaining agricultural workers has to a certain extent compensated for the decrease in the area of agricultural land, which in the fifteen years, 1909-1924, exceeded 5,000,000 acres, and in the number of farms, which between 1910 and 1925 declined by more than 42,000. There was during the same period an enormous decline in the production of cotton, due to a decrease of more than 2,000,000 acres in the area of land devoted to the cultivation of this crop. The remarkable increase in the production of tobacco and peanuts that took place at the same time required only a relatively small increase in the acreage devoted to these crops.

Between 1909 and 1924 there was a decline of 24 per cent in the total yield of grain crops—corn, wheat and oats—in Georgia. In the corn yield there was a decline of 11,000,000 bushels; in oats, 2,000,000 bushels; and in wheat, something more than 500,000 bushels. The yield of oats, which can be regarded as the standard grain feed for draft stock, has been falling steadily since 1909. The decrease in corn and oats largely follows from the increased used of automobiles, trucks and tractors which not only have replaced draft stock in the cities but have accounted in part for a decrease between 1909 and 1924 of 18,000 in the number of draft animals employed on Georgia farms. Since 1909 there has likewise occurred a decrease in the amount of hay produced in Georgia, ascribable to the same conditions.

Increase of Cultivated Acres Uneconomic

For more than a century the land policy both of the Federal Government and of the States, so far as the States have assumed the responsibility of a policy, has been to open up more and more land to be settled and occupied by farmers. There has been no restriction in the competition, and with the exhaustion of the land available for natural cultivation there

has followed a general movement to develop for farming lands that cannot be farmed except by irrigation or drainage, partly at the farmers' expense. It is safe to say that in this policy of expansion there has been too little thought for the farmers' welfare.

In 1925 the Secretary of the Interior said, "There is no need for more reclamation projects until the present ones are on a sound basis. One-third of the projects are insolvent; one-fourth should never have been built. Six thousand farms irrigated by the Government are without occupants." Yet these irrigated reclamation projects are supposed to be the favored lands on which crops are certain.

The general policy of the States has been to dispose of all their lands regardless of suitability for farming. This has led to the granting for homestead purposes of thousands of acres the clearing and cultivation of which should never have been attempted. It was disastrous for the homesteader who, with his family, often spent years of toil, only in the end to have the bitter disappointment of failure and realization that a decent living could not be made under existing conditions. He lost his time, most of his labor, perhaps invested money in addition.

A second consequence of the clearing of so much rough land has been an enormous increase in the quantity of soil eroded from the naked surface of this land after cultivation ceased. This has been an element in the low returns from hillside farms. It has laid an additional burden on the farmer as well as on others in the way of taxes. This erosion of soil has necessitated continued dredging of stream channels to keep them open; it is now threatening the permanency of storage reservoirs of hydro-electric power companies—a consequence really more important to the people of this state, because power, and cheap power, now is an important factor in determining markets for farm products and in determining the cheapness of goods used by the farmer.

It is my opinion that under these conditions the land policy to be advocated is not the clearing of additional lands. With the continued decline in rural population the opening up of additional lands mean, as a rule, drawing people from established agricultural communities. The older communities are weakened and the newly established communities remain weak. Such a policy would tend to maintain the condition that in the past has retarded rural development over so much of the country, especially in the South. Would not the desirable policy at the present time be to take measures that will tend to check the further clearing of woodland? Is not the best way to do this to take such a course as will make land that is now in woods most profitable as an investment?

Woodland Are Investment Opportunity

There are some six million acres of waste and unproductive land in Georgia. It can safely be said that not one-tenth of the woodland of the state is producing two-thirds of its normal capacity, and large portions are producing less than one-half their capacity. These estimates do not include stands of old timber the growth of which is stationary.

For the past 50 years Georgia has been exercising itself to secure industrial capital. Capital is not necessarily invested money, but may be property that has a producing capacity. Woodland now offers an opportunity for developing an enormous amount of increased capital at a very slight outlay. It requires the raising of no large sums of money for purchase or investment. It demands no increase in labor cost such as is required for handling an increase in farm area. A local or nearby market awaits the product. Timber is now coming into the eastern states from the Pacific Coast and from the lower Mississippi Valley region. This state has the differenece in freight as its extra margin of prospective profit.

It is necessary to stress the desirability of the adoption of a

definite policy in regard to the use of land. Certain lands at the present time should be considered as essentially suited to the growing of timber, and should be managed with this object in view. It is not desired in any way to disparage the importance of the further extension of agriculture whenever economic conditions justify it; but extension of the farm area should be restricted until the earnings of the farmer are on a higher level. Land not now in use for farming should be put to use in the production of timber.

In order to make possible the best economic use of Georgia's potential timber crops, it is necessary that new uses for certain classes of wood be developed. Already the state has an enormous and always increasing area of small and low-grade timber, second growth of inferior quality. Not only must wood-using industries be developed, but the utilization of cellulose, the most important content of wood, should be developed and extended by means of the chemical industries. This can be accomplished only by means of adequately supported research.

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Georgia Forest Service

B. M. LUFBURROW, *State Forester*

Planting Pines In South Georgia

By

FRED. B. MERRILL

CONTENTS

Planting Pines in South Georgia

Can Pine Trees Be Replanted?

Many land owners in South Georgia still believe that it is impossible to transplant a pine tree and get it to live, yet other land owners in this same section have already transplanted the little pines to the extent of several hundreds of thousands with success. Many mistakes have been made in establishing these early plantations, yet there is conclusive evidence here and elsewhere that the idea is practical and that satisfactory profits are to be expected from the undertaking. This bulletin is distributed with the idea of aiding many to avoid the losses which some of the early planters sustained.

Where to Plant

In the first place there are many areas with such an abundance of seed trees, left from former logging operations, that nature will reseed the areas if forest fires are prevented. In general, if there are three or more seed trees per acre, well scattered over the property, the economy of artificial planting of trees is doubtful. The word "economy" is chosen in this instance because there is a growing belief that the greater number of mature trees per acre, the better spacing, and the greater ease of management that result from planting, will more than offset the extra costs. However, no plantings in South Georgia have as yet reached merchantable size, so no conclusive proof is available. Therefore, it can only be recommended that land owners go slowly in their planting operations on areas where natural reforestation can be obtained. This confines the sites definitely recommended for planting to old fields and areas without enough seed trees.

Fire Protection

No plantings will survive and no great amount of natural reproduction can be expected unless all fires are kept out of the

area for at least three years after the planting or after the seed year, so the land owner should not waste his time and money in planting unless he expects to follow up with a plan of forest fire protection. If fires can be prevented for three years, which has now been done in many places in South Georgia, it is reasonable to expect that the land owner can protect his property indefinitely, thus getting the benefits of the greater vitality and increased growth which his trees will have when protected from fire.

WHAT TO PLANT

Once it has been decided to plant certain areas, the next question is what shall be planted? Most people in South Georgia are thinking only of slash and longleaf pines, so these species will be the only ones given consideration in this bulletin. However, there are many other good trees to plant, information about which may be obtained by writing to the State Forester in Atlanta.

The slash pine (Pinus caribaea) now has the lead in popularity over the longleaf (Pinus palustris) for reforestation work. This popularity is deserved to a certain extent, but the longleaf pine should not be despised for it is probable that on certain sites, such as sandy ridges, it will do better than the slash pine. However, it is generally conceded that the slash pine will grow a little faster in early years, that its wood will sell equally as well as the longleaf pine, that it will produce a little more gum, require a little less scrape, and make a little better grade of naval stores products. Slow growth in early years has been one of the handicaps of the longleaf pine, but this has been overcome to a certain extent by the use of vigorous nursery grown planting stock. Such stock enables the longleaf pine to compete fairly well in height growth with slash pine planted on the same land.

HOW TO SECURE REFORESTATION

Broadcast Sowing—A number of ways of getting a stand of pines has been tried. The first method that usually appeals

to people is to sow the seed broadcast. One trial of this method is usually enough. About all that is accomplished is to furnish birds and rodents with a supply of food. A few successful stands have been secured by this method, but even in these instances it has been found that the cost is too great. From 3 to 5 pounds of seed per acre are required, making the total cost of broadcast sowing $10 per acre and up, and with results not at all certain. It is advised that broadcast sowing not be tried.

SEED SPOTS

Another method sometimes employed is to sow seed spots. In other words, in every place that one wants a tree, hoe up a little spot and plant a few seed. Then when the trees come up, thin them out in case there are too many. This method is a little less expensive than broadcast-seeding and is a little less susceptible to damage by birds and rodents, but little better results can be expected from seed spots than from broadcast sowing.

WOODS-GROWN SEEDLINGS

Another method that appeals to the land owner is to go out in the woods and dig up or pull up little seedlings and transplant them. This method has considerable merit, but it is open to many objections. The beginner usually feels that the bigger the young tree he can get, the better start he has and he takes trees from 3 to 6 feet tall. If so, he finds that it requires several minutes to dig one tree, that only a few trees can be transported at a time, that the trees are difficult to handle and finally that he will need a posthole digger to plant them. Of course, the cost of planting such trees is excessive and at the end of the year the planter is almost sure to be discouraged, for most of the trees will have died from the shock of transplanting, or from the results of poor handling. Woods-grown seedlings one or two years old may be successfully transplanted, but trees taller than two feet should not be used and trees of less than one foot in height will prove to be the most satisfactory.

SEED-BED SEEDLINGS

The surest and most satisfactory planting stock may be obtained by using seedlings grown in seed beds. One-year-old seedlings of this sort have better root systems and a greater percentage of them survive. The growing of seedlings in seed beds is discussed in detail further on in this bulletin.

State Tree Nursery at Athens

PLANTING MISTAKES

A number of other mistakes in planting have been observed in South Georgia, and in almost every case they have led to poor results. Most people have been pulling up the seedlings. In order to do this they have selected young trees growing in moist areas and the damage to the roots has not been so great. As might be expected, however, on moist areas the food supply of the tree is more in solution than elsewhere,

consequently the young tree does not have to develop small fibrous roots as abundantly as do upland trees. Thus, the planter starts his operations with a poor class of materials, for young transplanted trees should have abundant fibrous roots.

Better results will be obtained from seedlings dug than from those that are pulled, for it stands to reason that pulling is going to injure many of the smaller roots. Therefore, use a spade or shovel to help get seedlings from the woods.

CARE OF PLANTING STOCK

After the seedling has been dug, either put it at once in a bucket partly filled with muddy water or else wrap the roots in burlap that is dripping wet. It is not necessary that some of the dirt remain on the roots. Be sure to keep the roots moist at all times while they are out of the ground. If they dry out, you will save time and money by throwing them away.

HEELING IN

If the trees cannot be planted the day they are dug, they may be "heeled in." This means digging a trench, setting the seedlings in it and covering their roots with moist, not wet, earth. Firm the earth around the roots, for if the air gets to them and dries them out, they will be no good. Plant the trees as soon as possible after they are dug and at all times keep the roots from drying out.

PLANTING SPACE

Several different spacings are being used for planting trees. These vary from 6x6 feet, or 1210 trees per acre, to 10x10 feet, or 436 trees per acre. The idea in spacing is to get as many trees per acre as that acre will grow satisfactorily and at the same time give the greatest value in forest products. If planting for timber alone, a close spacing (6x6 feet) is best, for within a few years the branches of adjoining treees will meet and the lower branches

will die out and fall off for lack of sunlight, thus reducing knots and assuring a maximum amount of high-grade lumber. If naval stores is the object of the planting, then wider spacing is desirable, for the yield of gum varies with the size of the crown.

Planting trees now is starting something that will not be available for use for at least twelve years. No one can tell what forest product will be most in demand at that time. Present indications are that the man who has timber fifteen years from now will reap a good profit from lumber and other wood products. The outlook for the naval stores industry is also promising. Therefore, it seems best to advise medium spacing that will work for the benefit of both lumber and naval stores. A proper spacing appears to be about 8x8 feet, or 680 trees per acre. With this spacing it is believed that the trees will grow vigorously until they reach 9 or 10 inches in diameter. This will bring them to the proper size for profitable naval stores operation. If at this time every other tree is worked for ten years for naval stores, the unworked trees will shoot ahead and the worked trees can then be removed, using them for low-grade lumber, posts, poles and fuel.

It is recommended that pine trees in South Georgia be spaced 8x8 feet apart, or at the rate of 680 trees per acre.

SOIL PREPARATION

A number of people have been using a middle buster or other plow to make furrows eight feet apart through the area to be planted. This removes the competing grass, makes planting easier and gives the trees a better chance. Another method is to throw two furrows together and plant in the loose soil. Both methods have met with success, but the plowing costs about a dollar an acre and the aim is to get a satisfactory stand of trees at the lowest possible cost. Some people are trying the planting of trees without any preparation of the soil, with satisfactory results. Both methods may be tried to make sure which works

best on each type of land. There has been some discussion of the treatment of areas to be planted when furrows are not plowed. Some believe that burning will make planting easier and reduce danger of insect infestation or disease, while others say that burning favors soil erosion especially harmful to very small longleaf seedlings. Burning of unfenced areas will also attract

(By courtesy of U. S. Forest Service)
Making Opening for Seedling

stock in the spring and the damage from trampling may be considerable. It is advised that burning before planting be avoided.

PLANTING METHOD

The planting of seedlings is simple. One man goes ahead with a shovel, spade, mattock, or a broad chisel-shaped tool, called a planting dibble, and makes a perpendicular slit in the ground. This is accomplished by forcing the tool straight down into the soil and then moving it slightly back and forth a few times until the tool can be easily removed, leaving a narrow slit deep enough and broad enough to hold the roots of the seed-

lings without cramping. A second man comes behind with the seedlings in a bucket half full of muddy water, or with 50 or 100 seedlings whose roots are well wrapped in a heavy cloth that is dripping wet. One seedling is taken out at a time and is placed perpendicularly in the slit. If the young trees are planted in furrows they should be planted not quite as deep as they were in the nursery or woods for the first rain will wash some soil around them and place them at the proper depth. This is particularly true of longleaf, which, if set too deep, is often smothered by silt. When planted on level ground, the seedlings should be placed at about the same depth they were when taken from the nursery. The seedling is held in the slit at the proper depth

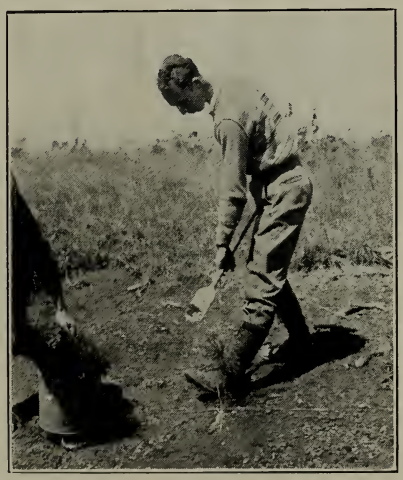
(By courtesy of U. S. Forest Service)

Placing Seeding in Opening

with the left hand. The right heel can then strike the soil about three inches away from the slit. A good hard drive with the heel will force the soil back in place solidly around the roots and a few more thrusts with the foot will tamp the earth sufficiently. If the earth is not well firmed around the roots, the air will enter and dry out the soil and the tree will die.

On harder soils it may be necessary for the man with the spade or other tool to help get the earth back around the roots. This may be accomplished by forcing the tool into the ground a few inches in front of the first slit, and prizing the earth toward the seedling.

It is easily seen that the above methods can be used only with small seedlings. Trees two or more feet in height will have a root system longer than the face of the spade or other tool and the roots would be cramped in the slits. If larger trees are used, be sure to dig a hole big enough for the roots. Sometime when the roots are rather long it is best to prune them back to about ten inches. This should be done with a sharp knife or other tool to make a clean cut.



(By courtesy of U. S. Forest Service)
Closing Opening With Thrust of Heel

PRUNING

Nursery-grown seedlings should have their roots pruned back to a length of about eight or ten inches, using a sharp knife or other instrument to make a clean cut. But two-year-old

woods-grown seedlings will usually have such long tap roots that such close pruning will remove too much of the root. In such cases, they should receive some pruning and the hole dug large enough to prevent cramping of the roots.

A few planters have pruned off the side branches of the little seedlings at the time they are planted and each year thereafter. Pruning a side branch or two at the time of planting may do no harm, but it must be remembered that the green pine straw is the place where the raw food taken in by the roots and from the air is changed so that the tree can use it. Annual removal of side branches from very young trees is harmful and will slow down their rate of growth.

PROTECTION

After planting, the trees require no watering or other attention except protection from fires and animals. Fire protection can be secured by plowing fire breaks around and through the plantation. Damage from animals can be prevented only by keeping them out of the planted areas for the first few years. Trampling of the young trees is seldom serious after the first two years, but hogs are especially fond of the roots of the longleaf pine and may uproot hundreds of the little trees. Some damage from hogs has also been noticed on slash pine trees as tall as ten feet.

GROWING SEEDLINGS

Most of the preceding information on planting will apply as well to nursery-grown seedlings as it will to woods-grown seedlings, but planting nursery-grown seedlings is recommended in preference to any other method of securing artificial reforestation. Nursery-grown seedlings have well-developed root systems; they are uniform in size; they are easy to secure; planting them is cheaper; and finally, it is believed that the average planter will get ten to fifty per cent more living trees than if he uses woods-grown seedlings. When the cost of gathering

woods-grown seedlings, the added cost of planting, and the resultant poorer stands are considered, it will be found that planting nursery-grown seedlings is cheaper.

BUYING SEEDLINGS

Some planters will wish to grow their own seedlings, but if there are less than 50 acres to plant, it will be cheaper to buy the seedlings than to grow them. They may be secured from the Forest School at the State College of Agriculture, Athens, Georgia, at the price of about $3.00 per thousand, or from Commercial Nurseries. The seedlings secured from the College are grown with the aid of Federal Funds allotted to the Georgia Forest Service, the Forest School being employed to grow seedlings and sell them at cost. It is probable that if the seedlings are grown in increased quantities, the price per thousand will be lowered.

The reason that buying small quantities of seedlings is preferable to growing them is that there are some little details to growing and caring for seedlings that in most instances will make it cost more to grow say 20,000 seedlings than it will to buy them. However, if one has time, or if a considerable area is to be planted, it will be desirable to start one's own seed beds. In such cases, the land owner will learn how trees grow, why they cannot be expected to live through fires, and the large planter will have available a supply of seedlings to use when he wishes.

COLLECTING SEED

To establish a forest nursery, the first thing necessary is good seed. These may be secured from several reliable seed houses whose names may be secured from the State Forester at Atlanta, or from the Forest School, State College of Agriculture, Athens, Ga. Seed should be planted within six months after they are gathered. To secure fresh seed, gathering them from the forest may be necessary. This is easily done. Follow a

logging operation in late September or early October when the cones or burs begin to turn brown and before they begin to open. Gather the cones from the cut tops of the trees. Under each scale on a cone are two seeds, which will fall out when the cone dries and opens up. When gathered, the cones are somewhat moist and apt to mould, so they should be stored loosely in sacks or scattered on a tight floor in a dry place where there is plenty of air. Within a week or so they will have dried out and opened up so that when one shakes the sack or the cones on the floor are raked about, most of the seeds will fall out and go to the bottom where they may be easily gathered when the empty cones have been picked up. A bushel of cones will release about one pound of seed, which means about 15,000 slash pine seeds, or 6,000 longleaf seeds. The wings on the slash pine seeds will come off easily when rubbed in a bag. This should be done and the wings separated by blowing them out or dropping them from a short height onto a paper so that the wind can blow out the wings. The seeds thus cleaned will be found easy to handle and plant. The wings will not come off of the longleaf seed, but they should be handled as above so that they will be as clean as possible.

If there is no logging operation near, cones may be picked from the tree. One man can gather as many as ten bushels of cones in a day if he is equipped with tree climbers. He should pick or cut the cones from the tree, letting them drop to the ground where they can be quickly picked up.

TIME TO PLANT

Seed beds may be planted any time during the winter months, but November will probably be better for the longleaf pine and February or March for the slash pine. No treatment is necessary for the longleaf pine seeds, but the slash seeds may sprout quicker and more evenly if they are soaked in cold water for about three days before planting. A method which promises to give even better results with the slash pine is as follows:*

Clean slash pine seed may be mixed with moist peat and

placed in trays of cheesecloth bags and kept in cold storage or in an ice box for two months. The peat is kept moist and the bags or trays are taken out about once a week and stirred to aerate them. Seeds treated this way may sprout quicker and more evenly than untreated seeds. Quick and even germination of the seeds will give an even stand and much more successful seed beds.

SEED BED PREPARATION

Seed beds may be located in the open or in a place where there is some shade during part of the day. A supply of water should be near at hand. Any sandy loam is suitable and fertilizer is not necessary unless the beds are to be kept more than one year in a place. The soil should be well worked up to the depth of about a foot, and all grass, weeds, sticks and other undesirable matter removed. The beds should not be more than four feet wide because weeding will be necessary and a bed wider than this cannot be weeded easily from the side. The length of the bed does not matter, but since a screen will have to be used to keep birds and rodents from getting the seed and the young sprouts, a bed 12 to 25 feet is recommended as a desirable length.

The soil in the bed should be slightly higher than the surrounding surface to insure good drainage. The bed should be surrounded by a frame of 1x4 inches or 1x6 inches of wood to hold the screen. The dimensions of this frame and material may be altered to suit the individual needs and the materials at hand. If there is reasonable assurance that birds will not damage the beds, then no frame is necessary.

Let the bed settle for a week or so before the seeds are planted.

SOWING

About 75 slash or 40 longleaf pine seedlings per square foot of seed bed are desired. Only about half of the seed can be counted on to grow, so a pound of longleaf seed should be sown on about 80 square feet of seed bed and a pound of slash

seed on about 120 square feet. In planting, the seed should be distributed evenly over the bed and then pressed into the soil with a board. After this, clean sand may be sprinkled over the seed until they are barely covered. If covered too deep, the results will be poor. Excellent results have been secured without putting any sand at all over the planted seeds and some large nurseries follow this practice.

COVERING

The next thing to do is to cover the bed with a burlap cloth laid directly on top of the soil or seed and held down with spikes or stones to prevent it from blowing away. Another good mulch to use in place of the burlap is about two inches of clean pine straw. Care should be taken to water thoroughly and evenly and not to put water on in such quantities that the seed will be washed out. A sprinkling pot or fine spray nozzle will do the work best. Watering should continue at one or two-day intervals for about two weeks. At the end of ten days the bed should be examined and the burlap or pine straw cover should be removed if there are about 30 longleaf or 50 slash seedlings showing to the square foot. At the end of fifteen days if there are still not that many seedlings showing, it is probable that the seed were faulty, or that something was wrong with the planting method. The burlap or pine straw should then be removed anyway. Sometimes if planting has been done during a period of cold weather, the seeds may need a longer time to germinate. After the covering has been removed, watering should still be continued for a week or more, for many other seeds will probably sprout.

PROTECTING

The greatest damage to seed beds in South Georgia has come from birds, which eat the seed or bite off the tops of the very young seedlings in order to get the seed coats which have not yet been discarded. Losses as high as 50 per cent may result from

this one source. Some seed beds located near homes are not subject to this trouble, but in general it is best to cover the beds with screen wire having about two meshes to the inch. This wire may be tacked lightly to the seed bed frame or it may be mounted in a separate frame that will fit tightly on the seed bed frame. The bed should be screened immediately after the covering is placed over the seed.

WEEDING

Weeding the beds should begin as soon as the covering is removed and should continue once a week as long as necessary. If the weeds are allowed to get to any size they will choke out the seedlings and when the weeds are then pulled they will loosen or even bring up the seedlings with them. It is very important that the beds be kept free from weeds. Many good beds have been entirely lost by the neglect of this one operation.

When most of the seed have sprouted, watering may be partly discontinued, but it should be remembered that a great many seedlings are growing on a square foot of ground and that they are using a lot of water. Therefore, if a week goes by without a good rain, the beds should be thoroughly watered.

During the first six weeks of their life, seedlings are very tender. If the weather is hot, they may suffer sun scald. This can be avoided by partly shading the beds. In most instances shading will not be necessary. Another trouble may result from a disease called "damping off," which attacks seedlings up to about eight weeks of age. This disease causes seedlings to wilt near the ground level and they soon die. The disease is not apt to be present unless the seed beds are maintained at the same place for several years. If the disease appears, change the site of the seed bed each year. When it appears in a bed, stop watering for a few days and sprinkle the bed lightly with dry sand.

During the summer, regular weeding and occasional watering is all that will be necessary, and during the next winter the young plants will be ready for the field. A spade or shovel, or

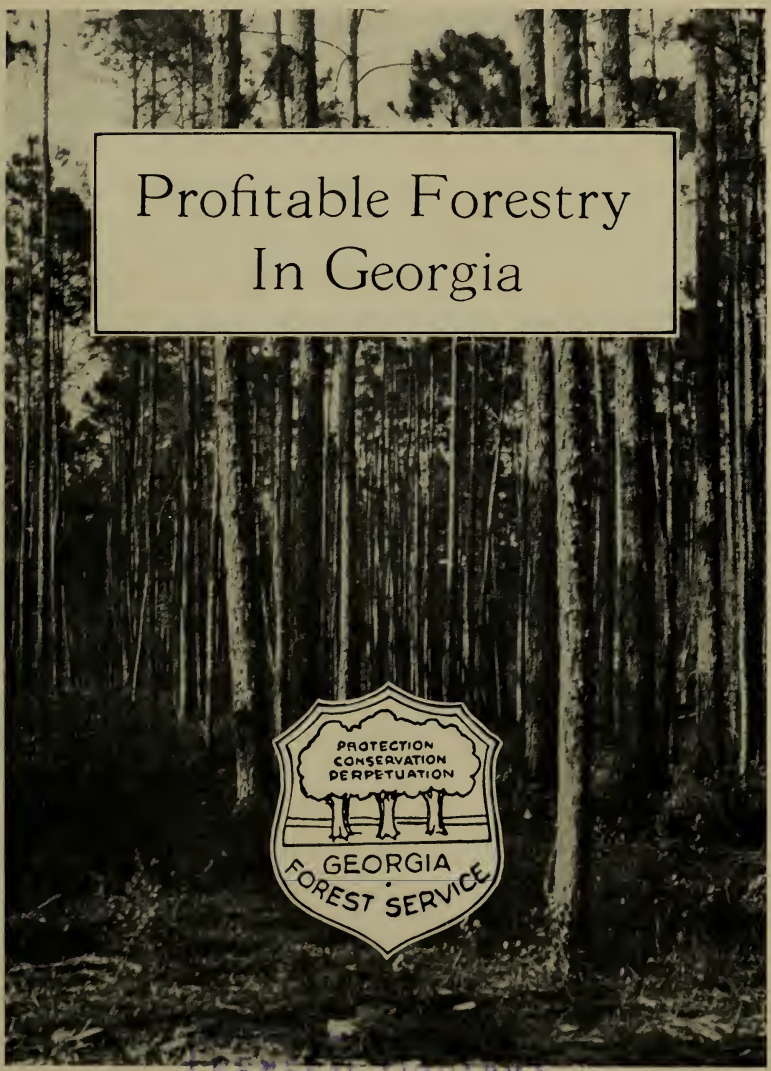
spading fork makes a good tool for lifting the plants from the bed. Care should be taken that the seedlings are lifted and not pulled. When lifted, the earth should be gently shaken away from the roots and the roots should be immediately wrapped in a wet cloth or packed in shagnum moss or "shingle toe" to prevent drying out. Lift only as many seedlings as you expect to plant that day.

*Lela V. Barton, Boyce Thompson Institute for Plant Research. HASTENING THE GERMINATION OF SOUTHERN PINE SEEDS, Journal of Forestry, October, 1928.

BULLETIN 10 MAY, 1930

Georgia Forest Service

B. M. LUFBURROW, *State Forester*



Introduction

This bulletin has been prepared primarily to report the progress that some timber owners of Georgia are making, and to give in their own words, what results they have obtained, how they have obtained them and what they hope to accomplish. Only a few of the many reports that could have been obtained, are given herein, but from time to time it is expected that others will be secured and published.

It is believed that everyone who reads the experiences of these timber growers will be thoroughly convinced that it pays to prevent forest fires and, we believe, they will become enthused over the possibilities of growing trees in Georgia.

Experiences are given in this bulletin from the small 30-acre timber grower to the large 200,000-acre commercial forestry project; from the pine belt and hardwood belt; from women managers as well as men; from school forests and town forests; from timber located at tidewater and on mountain crests; from lands operated under trained foresters and from novices beginning to deal with their forest problems for the first time. The whole reveals an awakening that promises well for the future of forestry in Georgia.

B. M. Lufburrow,

State Forester.

Profitable Forestry In Georgia

C. A. WHITTLE

Will it pay to grow trees in Georgia?

The object of this bulletin is to give evidence for our emphatic answer, "Yes".

Any commodity for which there is a demand has a value. What is the outlook for the demand for wood? This country is consuming wood faster than it is growing it, as evidenced by the fact that we are importing more than fifty per cent of our wood pulp material and some lumber is coming from abroad. The demand today in this country for wood is, in fact, greater in proportion to the supply than ever before.

When a supply decreases and the demand does not decrease, the consequence is higher prices. Because of the growing scarcity of wood, the general price level is quite a bit higher than it was 25, 30 and 50 years ago. This too in spite of the increasing use of wood substitutes such as cement, brick and iron.

Nothing can completely displace wood for building purposes. The more people there are the more wood there must be to house them, and to use for stores, warehouses, factories and for transportation facilities. The population of this country is far from the saturation point; therefore, the certainty of a continued demand for wood.

NEW AND OLD USES FOR WOOD

Furthermore, new uses for wood are arising. The inventive chemist has turned his attention to wood fiber or wood cells, and lo! we have produced from wood artificial silk, non-breakable glass, non-combustible films, transparent paper, photographic films, sausage casings, vulcanized or composition board for making trunks; hat boxes, electric insulation, buckets, waste baskets; cellulose as a base for gun cotton, dynamite, smoke-

less powder; cellulose paints that can be sprayed on automobiles and other wood surfaces; surfacing material for cloth to make imitation leather; washable wall paper; imitation ivories of many colors, artificial pearls, brooches, necklaces, buttons, fountain pens, knife handles, and on and on. The possibilities seem unlimited.

Then too, the chemists are finding new uses for naval stores, adding to the hundred or more already found for rosin and turpentine extracted from the slash and longleaf pines.

Just as the textile mills moved southward where cotton is grown, the paper mills are moving southward where wood fiber is growing faster, cheaper and in greater abundance than anywhere else in the United States. Chemical genius has already learned how to economically convert southern pines into white paper as it had already learned to use many hardwoods in which the south abounds. And the demand for paper is increasing enormously.

Veneer manufacture is a comparatively new industry. It is making rapid progress in Georgia where red gum, white oak, cherry, tupelo, magnolia, yellow poplar, black gum, walnut, maple, bay, sycamore and other species are providing material for interior finishing, furniture, baskets, boxes, crates, etc. An increasing demand for veneer materials is certain, and other species of wood will doubtless be brought into use for this purpose.

The demand made upon Georgia forests for telephone, telegraph, electric power poles and for crossties, is certainly showing no sign of decreasing but rather to the contrary. Except for seasonal variations the demands for saw timber show no decrease and the output of lumber, shingles, plywood, staves and headings keeps up and is providing a local source of wealth and employment that has meant much to the financial welfare of the State.

All in all, there is abundant evidence that the demand for forest products is not a matter about which the timber land owners need to worry, but the evidence is that there should be great concern about preparing to supply the wood demand of the future.

It is too sadly evident that many timber owners in Georgia do not have a vision of the future possibilities of forest products, else there would not be so many forest fires nor would they show so little interest in forest management.

FOREST BURNING MUST BE STOPPED

Every year many millions of dollars of potential forest wealth go up in smoke in Georgia. The future tree crops are cut off and the established trees are injured, starved and retarded in growth, if not killed outright. So great is the damage of fire to forest growth that one can say positively that *little or no profit is to be obtained from growing timber if the woods are allowed to burn over annually.*

Many turpentine operators practice protective burning; raking around trees and burning the litter of the forest floor. But tests have shown that modern fire breaks and patrol will provide protection at less cost and with greater production of gum.

Many farmers burn off their woods to kill boll weevils, unaware that boll weevils do not hibernate in the forest floor material that is burned, but spend the winter under the bark, in knot holes, in dead standing trees, and other places where the fire does not reach.

Some burn to green up the pasture and in doing so, destroy the only good native pasture grasses—lespedeza and carpet grass—leaving principally wire grass and sedge grass for grazing.

Some burn to get a better view of quail and other game but in doing so they only drive out the game because their coverage and food are destroyed.

No good reason, as a matter of fact, can be given for burning off the woods. Unquestionably, the net results of forest fires is the destruction of actual and potential wealth.

The Georgia Forest Service is combatting forest fires by forming Timber Protective Organizations among timber owners, by publicity in the form of pamphlets and fire posters; by moving pictures displayed in rural schools; by cooperating with 150

consolidated rural high schools in establishing and operating school forests; by highway demonstration plots with signs showing how natural reproduction will take place if fires are kept out; by encouraging the construction of fire breaks and the use of fire fighting equipment; by exhibits made at the State Forest Fair and other fairs in the State; by syndicated newspaper articles; addresses before civic organizations; by urging the officers of the law to enforce the fire laws; by appointing fire wardens and by holding conferences with individual timber owners.

Fire protection through education of the public is a great undertaking. Unless leaders in every community will rally to the cause and lend their assistance, progress will be retarded and every winter and spring will continue to witness wealth ascending as smoke in every community in the state for many years to come.

HOW FAST WILL FORESTS PRODUCE WEALTH

It has been stated that wood can be grown faster in the South than elsewhere in the country. Sunshine, moisture, long growing season and rapid growing species are the chief contributing factors. Slash, loblolly and longleaf pines, yellow poplar and cottonwood are among the leading commercial species of trees with ability to grow very rapidly, but all species of trees show more rapid growth in the South than they do in the north and northwest because of the longer growing season.

In a word—the rapid growth and the species of trees growing in the South constitute the chief reasons why the south must be the important future source of forest products of this country.

Investigations by research workers on the rate of growth of slash, longleaf and loblolly pines in the south show that even where no effort at forest management is made there are 1½ to 2½ cords growth per acre annually. Some data indicate that yellow poplar and cottonwood are practically as rapid in growth as the pines mentioned. Had these forests of pine been given

proper management, and the plant food and moisture of the soil been directed into desirable trees rather than into suppressed trees and undesirable species, the growth rate could be reasonably expected to be at least a half cord more per acre annually. Therefore, it is not unreasonable to expect that on average land, well stocked with the more rapid growing species that it is possible to have an annual increment of growth of 2½ cords per acre.

How much wood is Georgia growing annually on its more than 23,000,000 acres of forest and semi-forest land? Probably less than half a cord per acre, because of poor stands, fires that keep down reproduction, and lack of proper thinning and improvement cutting. In other words, Georgia is not growing as much as 15 per cent of the wood it is capable of growing on its present forested area. What this loss will amount to can only be guessed, for no one knows how much forest products will be worth in the future. It is certain that the total output could be seven times more than it is and the value increased as much as the future demand and ready markets will bring.

The establishment of paper mills and other cellulose industries in the South, and fuller utilization of forest resources in other ways by other wood-working plants, certainly heighten the prospects of the forest wealth of Georgia.

LAND UTILIZATION

Land too poor to grow agricultural crops profitably can grow trees successfully. Many acres of abandoned farm land not now needed for growing crops and many acres now cultivated at a loss should be allowed to grow trees. Much of this agricultural marginal land will come back under natural reforestation if fires are kept out. Other areas should be planted. It is probable that at least 6 million acres of abandoned farm land and land of low productivity could be added to the 23,000,000 acres now in forest land in Georgia.

Tree growing is one of the safest and surest ways of getting returns from land. The outlay for labor and other expense is

insignificant as compared to farm crops and land on which owners are now paying taxes without any returns can be made to develop wealth for the owner.

FOREST HARVESTING AND ROTATION

Because of their quick growth, their adaptability to various soil types, hardiness and their many uses, growing southern pines is particularly attractive for investment. Because of their ability to produce gum profitably, slash and longleaf pines have an advantage over other pines in wealth production.

Under natural reforestation pines come up to a thick stand. Economic management as a rule recommends that these pines be allowed to grow thickly until they are large enough to produce fence posts and firewood before the first thinning. A second thinning can usually be made after the trees have gained nine inches or more in diameter. Before the trees are removed they may be turpentined, and then marketed as pulpwood, poles, crossties, etc.

The second thinning reduces the stand to a point where the remaining trees will make rapid growth in reaching saw timber size. Before being harvested, they too can be turpentined. After being cut into logs the tops and larger limbs can be marketed as wood for paper manufacture.

Reforestation will have begun after the last thinning so that a new crop of trees will be well on their way by the time the saw timber is cut. Thus a crop rotation will be in progress.

It will be observed that in the course of one generation of slash or longleaf pine, it is possible to get four crops; first, fire wood and fence posts; second, gum and pulpwood or poles; third, gum, and fourth, saw logs and pulpwood. The cropping program for loblolly and shortleaf pines will be similar except for the gum.

While a number of hardwoods will yield larger returns per board feet as saw timber or veneer than pine, they grow more slowly and will not give as large return per acre over a number

of years as pine. Perhaps yellow poplar, black locust and a few other quick-growing valuable trees will approach pines rather closely for per acre returns, but as a rule the quick-growing hardwoods can be grown successfully only on limited areas.

The conclusion is that Georgia should emphasize pines as their state-wide forest money crop. Pines can be grown successfully in all parts of the state, on poor as well as rich soils, and, as a rule, find a local market ready to absorb their output.

FOREST-MINDED GEORGIANS

This publication is issued primarily as a recognition of the services rendered forestry by Georgians who have a vision of what forest production means, Georgians who are protecting their trees from fire, promoting reforestation and practicing good forest management, including wise utilization. Their example, it is hoped, may be an incentive to others to do likewise.

By no means has the field been covered. From time to time, it is our purpose to record in publications similar to this, the outstanding examples of progress in restoring to Georgia its ancient glory of forests and forest products.

WHAT SOME GEORGIANS ARE DOING TO DEVELOP THEIR FOREST RESOURCES

Members of the staff of the Georgia Forest Service have obtained the following statements from timber owners as to what they are doing to develop their forests, their observations and conclusions. It will be noted that these timber growers are strongly of the opinion that trees must be protected from fire to do well; that land undesirable for farm crops produce trees successfully; that trees grow more rapidly when properly thinned.

PIONEER IN FOREST PROTECTION

W. J. Mullis, Waycross, Route 4, owning 223 acres of pine land, began the care of his forest 22 years ago. The land is well

stocked, due to fire protection. Mr. Mullis says:

"Having been born here in South Georgia, I have had the opportunity of seeing this country from its virgin state with its billion dollars of wealth in the stately yellow and slash pine, and also have seen this pine ruthlessly wasted by fires, saw mills, turpentine, crossties, etc.

"I saw years ago the necessity of trying to preserve the forests that the next generation might have a little of what my generation had much of. So, thirty odd years ago, I went to preaching and trying to practice conservation against all seeming odds, and by using roads and plowing breaks have succeeded in a limited way. But could I have had the Forest Service aid thirty years ago that we now have in educating the people in conservation

W. J. Mullis, Waycross, Route 4, Pioneer in Fire Protection—View of Some of His Forest Land

of the forests, I feel that we could have had a country, now in its childhood, coming to the high standard of wealth that it enjoyed sixty years ago.

"I expect to preach and practice forest preservation in my humble way, and aid in any way I can in educating the people

up to a higher standard, that our country may have a little of what God's laws of nature have in store for us."

POOR PROSPECT BECOMES BRIGHT WITH PINES AND CARPET GRASS

C. L. Williams, Vienna, Ga., with 400 acres of slash pine, began protection of the forest in 1910. Read his interesting statement of what he has accomplished:

"When I came to this place 20 years ago I began protecting my land from fire. At that time the turpentine men thought the timber wasn't worth looking at, but now they want to cup all of it—all because I protected it from fire.

"My timberland is mostly in the low, moist places, and is now covered with a good stand of carpet grass. I first noticed

C. L. Williams, Vienna, Estimates 4 to 5 Per Cent Returns on Investment in Pines

the carpet grass on an old sawmill site, where the cattle kept it grazed down. Since then, it has spread all over my woods and makes an excellent pasture, except after a heavy freeze, when I

cannot use it for 3 or 4 months. Some years the pasture stays green all winter, and I can pasture my sheep all of the year. I also notice that where the grazing is heavy, the carpet grass is killing out the gall-berry.

"I find the best way to keep down the fire is to graze my pasture to the maximum. This will prevent the grass from getting rank and will reduce the fire hazard. Wherever I can keep out fire the young slash pines come in thick, grow fast, and have a much healthier color and appearance than saplings that are burned. I have some land that I have not protected from fire, and here there are very few saplings coming in.

"I think protection from woods fires is a paying proposition, and estimate that the growing trees on my woodlands are paying taxes and yielding 4 to 5 per cent on the investment."

RESTORING CUT-OVER PINE LAND

Albert Harper, Osierfield, Ga., with 2200 acres of slash and longleaf pineland, decided in 1920 to utilize cut-over pineland and concluded that the best way was to grow pines. He has planted and protected from fire with fire-breaks. Here is his statement:

"After the timber had been turpentined and saw milled, I saw that the only way to make my land pay was to protect it from fire and let the pine trees grow. At the present return on farm land it will not pay to clear the cut-over land and raise farm crops. We do not have a fence law and cannot make any money in cattle. So the only way the cut-over lands will pay taxes and give an income is to raise pine trees.

"I began in 1920 to try to keep out the fires, and had fairly good results where I could watch it closely. Four years ago I began plowing fire breaks and find these are a great help in keeping out the fire. I plow strips about 15 feet wide, but I think they should be at least 20 feet wide.

"I have noticed that where my land is protected the pine trees come in very thickly, grow fast in height, and grow from one-

Albert Harper, Osierfield, Finds Fire Protection Brings Pine in Thickly and that They Grow Rapidly

fourth to one-half inch a year in diameter.

"I do not expect to harvest much of the second-growth timber on my land, but young thrifty trees increase the value of the land, and my boys will be able to make some money out of it.

"Growing timber on land that isn't profitable for farm crops is a good thing for the community. It gives the laboring man a job, the railroads business, the wood-using industries a source of raw material, taxable wealth for the county, and a profit for the owner."

LEADING PLANTATION OF SLASH AND LONGLEAF PINE

On account of its location on a much traveled highway, the plantings of slash and longleaf pine north of Cordele is probably the best known pine plantation in Georgia. F. E. Fenn started this plantation which is being enlarged by his daughter, Miss Alene Fenn. As a combination pine and pasture proposition, this project promises to be very intersting. Miss Fenn's statement follows:

"In the spring of 1926, my father, F. E. Fenn, had some low, waste lands that were not producing anything to pay taxes or interest. From a natural love of the pine tree and a desire to make waste land pay an income, he conceived the idea of planting this land to pines. Being a turpentine operator, he naturally viewed the enterprise from a business standpoint, and considered that the planting of trees would yield a good return at a future date. He was the first man in this section of Georgia to plant slash pine trees, and stated he wanted to be the first man to cup trees that had been planted.

Fenn Plantation of Slash Pines Near Cordele Growing Rapidly—Attact Attention on Leading Highway

"My father planted 40 acres to slash pine in 1926 and planned to perpetuate his turpentine business by doing some planting work every spring and working his timber conservatively. The seedlings were pulled up in the marshy places, put in

a barrel of water, and then set out in rows 8x8 feet and 10x10 feet. The roots were kept moist all of the time, and the trees were carefully planted; resulting in 90% establishment.

"My father did some planting every spring since 1926, and since his death, we are carrying on the work. At present we have approximately 150 acres of waste land planted to trees. The trees planted in 1926 now average 10 to 12 feet in height, and will probably be 9 inches in diameter in from 12 to 15 years after planting. The trees are making excellent diameter and height growth, and we expect to be able to work them in 1940; or as soon as they reach a 9-inch diameter. In our turpentine business we have established 9-inch as the minimum diameter for cupping.

"A 75-acre tract, along state highway Number 7, three miles north of Cordele, that my father first planted is being created into a memorial to him. It is being deeded to all of the heirs and cannot be sold or divided as long as any of the heirs are living, and as long as the Georgia laws will permit. Carpet grass and lespedeza have been planted among the pines on this 75-acre tract, and we are now grazing 40 head of dairy cows on it.

"We consider growing pine timber and grazing cattle to be a profitable business."

PINE PLANTING INCREASED LAND VALUE 100 PER CENT

A. K. Rountree, Summit, Ga., began in 1926 to plant slash pine, also to protect from fire, thin and prune established forests. His planting experience is significant. The statement of Mr. Rountree is as follows:

"I started setting out pines in 8 ft. checks in the spring of 1926. I gathered these pines from old fields and along streams, planting 35,000 seedlings on approximately 40 acres, 25 per cent of which lived. Replanted the same fall and 75 per cent lived.

Each year now I have been getting seedlings from the State Nursery at Athens, and find that I get much better results for

more of them live. We planted 15,000 in January, 1930 and the district forester at Swainsboro states that 95 per cent of them are living.

"I notice that my trees grow more rapidly after the third year, and I believe that 10 x 10 feet spacing is ideal for this section of Georgia. That has been my experience. This land was idle until it was planted in slash pine and the value of the land alone has increased 100 per cent as compared to 1926. To date, I have received no actual money returns, but the land is building up instead of depreciating, and I expect to lease this for turpentine in 8 more years, which will net me more than I could hope to make by farming it."

TURPENTINE OPERATOR A LEADING TREE PLANTER

The work of James Fowler, Soperton, Ga., in planting and care of pines has attracted wide attention. His plantation has attracted many visitors, including federal and state foresters. The success attending his efforts has provided the basis of magazine and newspaper articles, and Mr. Fowler is quite in demand as a speaker at forestry conventions. The following statement of Mr. Fowler is of special interest:

"In 1926 I planted about 10 acres in slash pine, of which around 85 per cent lived and grew off fine. So in February, 1927, I planted 130 acres of slash seedlings that were one and two years old. These seedlings were obtained from old fields and along the heads of streams and were planted in rows checked 10 x 10 feet, which I have found to be the best spacing in my section. Today I have 1,000 acres planted in slash pine and of the last 640 acres planted, I received a 99 per cent. stand. There has been no fire on any of this land.

"In November, 1928, I saw a demonstration in fire break construction, and as fire was my greatest enemy, I determined to build fire breaks on all my timber land and protect my young timber, for I found that fire kills these little slash pines. Today I have fire breaks on all my land—5,200 acres—and have had

James Fowler, Soperton, Has Planted 1,000 Acres in Slash Pine with Excellent Results—Note in Picture Protected Trees on Left and Burned-Over Area on Right

only two small fires which were put out very easily because the breaks gave us an advantage by holding it down until the crew arrived.

"I have also done considerable pruning and thinning; removing undesirable, dead and diseased trees, and pruning up the balance to help reduce my fire hazard. Planting pines and protecting them certainly pays, for today I have a supply of turpentine timber that is second to none; while in 1925 it was just idle farm land that was a burden and didn't produce enough to pay the taxes. My land has increased in value 100 per cent and in 8 years I intend to turpentine my planted orchard. With the help of the Georgia Forest Service, I intend to keep growing timber which will insure me of a continual supply for my turpentine business."

FIRE BREAKS LET YOUNG PINES GET A START

James Peterson, Soperton, Ga., with 1,400 acres of land, decided to build fire breaks to keep his land from burning over

every year. He wants to grow longleaf and slash pines and red gum. He is practicing fire protection, thinning and pruning. His statement follows:

"I have lived in a turpentine country practically all my life and have seen the developments in forest management and especially in fire protection.

"In February, the Oconee Timber Protective Organization was formed in Montgomery and Treutlen counties, by the Georgia Forest Service. I listed my land and started immediately to build fire breaks like the ones I saw on Mr. Jim Gillis' timberland. Now I have about 10 miles of breaks and have not had a single fire this year. Every year except this one, the area had been burned over, killing and destroying my little trees, but last year was a good seed year and no fires on my land this spring resulted in a good stand of litle pines that are now just poking up through the wire grass.

"It certainly pays to protect your timber and especially the young trees, for that is the timber of tomorrow. My land has increased in value 75 per cent over last year, and also affords grazing for more cattle than it did when it was burned every year."

FIRE PROTECTION AND THINNING INCREASED GROWTH RATE 100 PER CENT

John J. Gillis, Soperton, Ga., with 12,000 acres, is protecting his timber with fire breaks, thinning, planting, pruning, using improved turpentine methods, and is an outstanding leader in this region. He finds that care of his forests increased tree growth 100 per cent. His statement follows:

"In 1927 I began protecting my timber by plowing fire breaks on about 5,000 acres, which at that time was supporting a stand of young slash pine. I knew that this was to be my future timber for obtaining my gum and that fire would kill it, so I decided then to have my land listed in the Treutlen Timber Protective Organization, and to build breaks on all of it. Today I have fire breaks on 12,000 acres and have had no fires to date.

Timber Protective Organization Methods Bring Large Returns According to John J. Gillis, Soperton

"I have planted 400 acres in slash pine in the last two years and have thinned and pruned over 4,000 acres, which has helped reduce my fire hazard and accelerated growth on the area worked over 75 per cent. I now have a good, even stand of young timber that is growing very fast, and by keeping fires out, this land has increased in value 100 per cent. I intend to begin working some of my young timber in 6 years.

"When I began work in 1927, my land was worth about $15 per acre. Now. I would not sell for $30 per acre. It certainly pays to keep out fires and grow timber. It is a good investment that will pay big returns, for when I get ready to sell my timber I can get my own price for it."

WOMAN LEADER PRACTICES FORESTRY ON PINE AND HARDWOOD AREA OF NORTH GEORGIA

Mrs. M. E. Judd, Dalton, Ga., landscape artist, woman's club leader, member of the State Board of Forestry, began in 1905 to improve 150 acres of woodland. She has established fire breaks, thinned and carried on improvement cutting. Her success indicates how many Georgia women can devote themselves to increasing the forest wealth of Georgia.

Mrs. Judd's interesting statement follows:

"Twenty-five years ago I acquired the home place at Dalton,

Georgia, on which I am living at present.

"When I first came here a stunted growth of pine and hardwood covered most of the place. I saw the necessity of taking care of my woodland if I was ever to have any trees that I might use for building purposes and for fuel. Every year the adjoining lands are burned over, but in spite of that, I have en-

Mrs. M. E. Judd, Dalton, Practices Forestry with Good Results—View of Fire Break

deavored to keep fire out of my woods, having had only one of any importance in twenty-five years.

"The result of this protection is very apparent. Tree growth has increased at an enormous rate, soil has improved because of forest litter, and the beauty of my place has increased a hundred-fold.

"Trees once stunted and small have reached a size ready to be

cut and young ones are coming in to take the places of those I will use from time to time.

"From suggestions made by the Georgia Forest Service I am endeavoring to work out a form of management of my woodland whereby I can get the greatest amount of forest growth by eliminating the inferior trees and allowing the best ones to grow. Fire lines have been constructed on all sides to better protect it from fire which may originate on adjoining land.

"I believe in protection of woodland and will continue to give my woods the best protection that is possible."

MORE GUM AND LESS DRY FACES WHERE FIRE BREAKS ARE MAINTAINED

J. M. Dyal, Baxley, Ga., a prominent turpentine operator, owning 19,000 acres, began forest fire protection in 1927 and is also planting trees. More gum, less dry faces and fewer dead trees are the results of his fire protection. He says:

"I have been trying to practice fire control on 19,000 acres of land in Appling county for the past four years. While it has

J. M. Dyal, Baxley, Gets More Gum From Protected Trees.

been expensive, I only wish I had started the work earlier as it is the only way for owners of cut-over lands to get a return on their investment. I have a complete fire break around the entire outside lines of my lands, and also inside fire breaks cutting this into smaller tracts, taking advantage of streams and roads wherever practical.

"I am working eighteen crops of turpentine timber on this tract, and find that it produces more gum with less dry faces and fewer dead trees than if burned over each year. I expected to have a good deal of trouble getting my labor to work on rough woods on account of the danger from snakes, but as most of the men are working on a basis of so much per barrel of crude gum they are now anxious to keep the fire out of their crops on account of the greater yield "

WONDERFUL GROWTH FOLLOWS FIRE PROTECTION

A. V. Kennedy, Waycross, Ga., began fire protection on 7,500 acres in 1927, and is practicing thinning. He notes wonderful growth and in two years he estimates that keeping out

A. V. Kennedy, Waycross, Finds Wonderful Increase in Growth of Young Pines When Protected from Fire

fire has increased the value $2 per acre. Mr. Kennedy advocates using the United States Army for fire patrol. He says:

"I have been protecting this land for three years and have had very little of it burned over during this period. I have a wonderful growth of young slash pine now. I would not have it burned over today for $2.00 per acre."

STAND OF TIMBER INCREASED 60 TO 90 PER CENT WITH FIRE PROTECTION

Marsh Brothers and Wilson, Stockton, Ga., with 15,000 acres of slash and longleaf pine are protecting, thinning, planting and using improved methods of turpentining, and are greatly pleased with results. Their statement is as follows:

"We began this project during the winter of 1925 and 1926. At that time the stand of timber was about 60 per cent, where now we have a stand of small timber of at least 90 per cent of the tract. Our main problem now is thinning the saplings out to a stand of about 15 x 15 feet.

Marsh and Wilson, Stockton, Increased Stand of Timber From 60 to 90 Per Cent With Fire Protection

"We have had no fires during 1928, 1929 and so far in 1930. With fire protection, the growth of the young timber is wonderful. We figure that we are growing about 75 per cent of yellow slash pine."

COLLEGE PRACTICES FORESTRY ON ITS 15,000 ACRES

The famous Martha Berry School near Rome has 15,000 acres of hardwood and pine forest. A stone fire tower has been erected on the mountain, fire breaks are used, thinning and improvement cutting and planting are practiced. The hundreds of students are getting a vision of forest production as a result. A statement by the school is as follows:

Martha Berry School, Near Rome, Teaches and Practices Forestry—Views of Fire Tower and Forest

"Forest protection has been carried on at Berry Schools for fifteen years. In 1928 Berry Schools cooperated with the Geor-

gia Forest Service in establishing a timber protective unit, thereby working out a better system of protection. A lookout tower has been erected on a high point within the school property which overlooks the entire area. Telephones connect it with all buildings. When a fire starts it is soon put out because every boy on the campus is subject to call if necessary.

"As a result of protection, much new growth has been started, the older timber has grown to a better advantage, reproduction is coming in as under-forest to older timber.

"The results of protection are apparent, and this is a fine example to hundreds of boys and girls who are students at Berry.

"Through cooperation with the Georgia Forest Service, we hope to make Berry Schools' forest an outstanding example of what timber protection will really do in the coming years."

EVERY TENANT A FIRE FIGHTER

J. Henry Gaskins, Nashville, has 6,500 acres in slash and longleaf pine, mostly slash. He is one of the pioneers in fire protection in South Georgia, beginning about six years ago. He is not only using fire breaks but is thinning and carrying on improvement cutting. Mr. Gaskins says:

"I have about 90 miles of fire lines averaging about 8 feet in width. These will stop fire some of the time and can always be depended on for backfiring. Every farmer I have is a fire fighter, and it takes organized help to stop fire.

"I have practically a full stand of slash timber on all my land from small ones in the grass to 20 feet high, and where there has been no burning (as most of mine has been protected) timber grows much better and is not stunted by fire. You can not have first-class young timber and burn the woods. Fire and timber don't go good together.

"I am unable to give returns as none of my reforestation trees are large enough to use, but it will give good returns in a few years. Woods can be kept rough with proper care."

LARGE COMMERCIAL INTERESTS PRACTICE FORESTRY

The Superior Pine Products Company, Fargo, has 200,000 acres of land growing slash pine, longleaf pine and cypress. An expert forester was placed in charge in 1926 at which time fire protection was begun. The Company practices improvement cutting, planting and improved methods of turpentining. A statement from this organization is as follows:

"This company maintains three look-out towers and from four to seven mounted patrolmen. In addition, during the seasons of high fire hazard, a special crew of five men equipped with truck, water pumps and other fire fighting tools, is maintained for the purpose of quickly going to fires as they are discovered and reported by the tower men or patrolmen. Each fall and winter prior to the main spring fire season from 150 to 300 miles of fire line are constructed or maintained.

"The total cost of fire protection amounted to 5.7 cents per acre per annum for the last calendar year.

"In 1926, before we were well organized, we had burned about 8 per cent of our area. In 1927, a very dry year, the burned area covered about 6 per cent. In 1928, the area burned was 0.7 per cent. and in 1929 the area burned was 0.6 per cent. The last two years have been wet seasons and very favorable for fire protection. If we can average over a period of ten years an annual loss of not to exceed 5 per cent of the area, we will consider our work very satisfactory. As a result of four years of fire protection, we have restocked with slash pine over 70,000 acres of cut-over land that previously was less than 25 per cent stocked with longleaf pine.

"Since our naval stores and wood products operations are all conducted on a basis of a continuous supply of timber, it is essential that we restock our land to fast growing slash pine just as fast as we cut it over. It is also necessary that there be no idle acres of land; every acre must bear as nearly 100 per cent of its tree-growing capacity as it can be made to do by good management and fire protection."

DALTON HAS A TOWN FOREST

One of the few cities owning a forest is Dalton. A forest of 30 acres consisting of hardwood and pine, typical of North Georgia, is being operated as a demonstration forest. The mayor of Dalton makes the following statement:

"Through the efforts of several of Dalton's leading citizens cooperating with the Georgia Forest Service, the Town Forest of Dalton, Ga., was created. Some thirty acres of the city property was set aside for a town forest in 1929. This thirty acres is covered with a 100 per cent stand of 8 to 12 year old shortleaf and loblolly pine.

Dalton Has Demonstration Forest

"This forest was established more for a demonstration of forest possibilities to the people of Dalton and Whitfield county than for its commercial possibilities.

"Efforts are being made to establish fire breaks and adequate protection from fire. A fire line on one side of the tract is being established the first year.

"Thinnings and improvements will be carried on in the fu-

ture so as to get the maximum growth per acre. It is planned to add additional open land of the city adjoining this tract which will be planted to pine.

"It is hoped that this forest will prove to be an inspiration to the people of Whitfield county, thereby creating a "forestry consciousness" which will materially benefit everyone in the county by advancing the cause of forest protection and growing of timber."

RESULTS ON GROWTH AND RETURNS ON CHIPPING SMALL TREES

The estate of C. S. Hodges, Cyrene, is making observations on rate of growth and gum yield of trees of different sizes. Charles S. Hodges reports:

"We have under observation two different tracts of approximately the same number of trees in each tract. One tract is cupped down as low as seven inches and another tract cupped down not lower than nine inches. From the seven-inch tract we got eight barrels of crude gum from three streaks, and from the nine-inch tract we got twelve barrels from three streaks.

"Judging from this, we feel safe in saying that it does not pay to cup lower than nine inches. Also, from borings that we have taken lately, we are convinced that the injury in growth to trees is 50 per cent greater when cupped small than when cupped nine and ten inches. By this, we mean to say that the growth per year over a period of from twenty to twenty-five years on trees cupped at seven inches would be not over a fourth of an inch a year, where on trees cupped over nine inches would be a third of an inch a year."

WORN-OUT FIELDS SET TO PINES

Berry Rigdon, Tifton, has 1,700 acres and is converting worn-out land to pine plantations. He is protecting from fire, planting, thinning and pruning, Mr. Rigdon says:

"I had some old, worn-out fields that would not pay to farm,

so thought I would set them out to pine trees. In 1928 I dug some slash pines out of the woods and planted them in some of my old fields. They were two year old seedlings and 90 per cent of them lived and are making wonderful growth. I have experimented with different spacings—using 6 x 12, 6 x 16 and 8 x 30 spacings. Some of the trees I expect to turpentine when they are 10 years old from planting. My minimum diameter for working will be 9 inches.

Berry Rigdon, Tifton, Plants Pines on Unprofitable Farm Land — Fire Protection Good Investment

"Two years ago I began protecting my land from fire by plowing and burning fire breaks. With two mules I plow two furrows about 40 feet apart and burn out the strip in between the furrows. I plow around the outside boundaries and cross break it so as to get it into 20 to 40 acre blocks.

"Protecting land from fire is a good investment because thousands of young trees get a start that would otherwise be killed by the annual fires. The trees grow a lot faster, are healthier and will produce more gum.

"I have thinned and pruned 50 acres of slash pine that came

up in an old broom sedge field. These trees were about 5 years old and 10 to 12 feet high when I pruned them. The thinning to about 250 trees per acre will increase the growth of the trees, and the pruning will make the body of the tree free of knots.

"I believe all timber owners will find it profitable to plant to pines all fields that will not pay as farm land."

PIONEER IN PINE PLANTING

After winning fame as a tackle on the University of Georgia team, W. O. Wingate tackled farming and is among the first to begin pine tree planting in Georgia, turning his attention to this on his farm near Ocilla in 1924. He uses fire breaks, plants, thins and prunes. Mr. Wingate says:

"In 1924 I found that a large portion of my farm land was too poor to produce profitable farm crops. Having noticed in some small corners where fire had not burned for a few years,

W. O. Wingate, Ocilla, Pioneer Pine Planter Well Pleased With Progress

that pine timber if given protection would reproduce rapidly, and that it is the crop nature intended for this type of land, I

set out to learn how to raise pine trees as a crop.

"After digging and pulling some saplings out of the branches and setting them in the open spaces I found that it was too expensive, and that it was much cheaper to either sow the seed in beds or get the seedlings from the Forest Service.

"I also found that if there are as many as two seed trees per acre over the woodland it is not necessary to plant—but just keep out the fire. I protect my land from fire by plowing fire breaks 12 feet wide, and locating them about 200 yards apart.

"In 12 to 15 years after setting I am expecting to work my trees for turpentine. By working conservatively I can turpentine them for at least 20 to 24 years.

"I have received much valuable information and assistance from the Extension Forester and from the Georgia Forest Service; and I would advise any landowner wanting to reforest to get in touch with these departments. He will find them always ready to render assistance."

FIRE BREAKS VERSUS CONTROL BURNINGS IN TURPENTINE OPERATIONS

Baldwin-Lewis-Pace Company, Jacksonville, Florida, operating 15,000 acres near Stockton, Georgia, make a statement through H. M. Wilson, Vice-President, showing how this company finds it pays to use modern fire protective methods instead of raking and burning around the trees. The statement is as follows:

"In the fall of 1926, after looking over several tracts of flat woods land that had been protected from fire for from two to four years, I became convinced that all that was needed to establish a second growth of slash timber on our place near Stockton, Ga., was protection from fire. After consulting with my associates we decided to place our tract of approximately 15,000 acres under fire protection.

"We immediately began construction of fire lines, and sup-

plied ourselves with one-man water tanks, torches, etc., for fire fighting.

"We were working at that time fifteen crops of faces on part of this tract and as we wanted to establish new growth on the land on which these faces were being worked, we decided to protect this land also and not rake the boxes at all.

"We have not raked a tree for the past four winters and in that time we have had not more than 50 faces burned out of an average of sixteen crops per year worked on the place. In this connection we acknowledge with sincere appreciation the community cooperation we have enjoyed.

"The average cost of raking being $75.00 per crop, we saved approximately $4,800.00 during the four years, and the total cost of our reforestation work on the entire 15,000 acres, including tractor and thinning, has not exceeded $5,000.00 to date.

"The problem now facing us for economical solution is how best to thin the heavy growth of slash pine now on practically the entire tract.

"This concern's holdings show slash pine 9 1-2 inches and 10 inches in diameter 4 1-2 feet from the ground, showing 11 and 12-ring growth, with density of stand 14 to 15 feet between trees, or approximately 200 trees per acre."

ICHAWAY TIMBER PROTECTIVE ORGANIZATION'S SUCCESS

The Ichaway Timber Protective Organization in Baker County directs fire control on 22,000 acres. Roy Rogers, secretary of the organization, says:

"With the exception of about 400 acres, our whole area had been burned over every year up till last year when we began fire protection work under the direction of the Georgia Forest Service.

"We patrolled, put in fire breaks and had very little burned. This past season we put forth greater effort and the results have been wonderful. Every acre of land that joins ours has been

Ichaway Timber Protective Organization, Baker County, Surprised at Results of Fire Protection

burned, and up to date we have had less than 200 acres to burn over. It is impossible to estimate this protection work. Our young timber has taken on new growth and looks fine."

TREES GROW FIFTY PERCENT FASTER WITH PROTECTION AND MANAGEMENT

Turner Turpentine Company, Howell, Ga., has 10,000 acres of cut-over pine land, now undergoing reforestation. Fire protection and thinning are bringing about rapid increase in growth as will be seen from the following statement:

"We commenced protecting our forest about two years ago. At first, about all the work that was done was thinning small saplings that were crowded. This was done on a very small area, and we now have wonderful results from this thinning. In my opinion, this young timber is growing 50 per cent faster than it was before it was thinned. During January, 1929, we put on a patrolman, and also put in considerable fire breaks, and since that time we have been keeping that work up. I can already

see wonderful results from this work, as large areas that have been protected from fire are now restored with young yellow pine saplings."

LARGE VIRGIN HARDWOOD FOREST UNDER PROTECTION

Shippen Hardwood Lumber Company, Ellijay, Ga., owns 48,066 acres of mountain hardwood forest on which fire protection has been carried on since May 1928. A statement from this company is as follows:

"This company owns approximately fifty thousand acres of forest land located in Gilmer, Fannin and Murray counties, Georgia. Practically all of this area is virgin forest and most of the timber is hardwood. This tract is one of the largest remaining virgin hardwood tracts left in the United States. The forest contains a fair stand of yellow poplar, white and red oaks, and numerous other hardwoods, together with a considerable amount of white pine.

"The present owners of this tract have this land under organized protection from forest fires in cooperation with the Georgia Forest Service. So far, no active timber operations have been conducted on this holding, the idea being to protect it from fire in order to prevent damage to the mature timber and to enable the young growth to establish itself under the mature stand.

"Like most of the other forest areas of the Southern Appalachian mountain regions, these lands have suffered from periodic burning over a period of many years and the forest has been damaged, especially through the destruction of young growth.

"The owners fully appreciate the value of fire protection and it is their hope that when the mature timber is removed that a second growth will have been established to take the place of the original stand. The fire protection work is under the direct supervision of an employee of the company and a warden system has been developed among the inhabitants of adjoining lands.

"Fire warning posters and personal contact work is done in

an effort to prevent the occurrence of forest fires as well as the suppressing of fires which do occur."

PFISTER AND VOGEL LAND COMPANY PROTECTS LARGE MOUNTAIN HOLDINGS

The Pfister and Vogel Land Company, Blairsville, Ga., owns 65,000 acres of mixed hardwoods, and began active forest management under Bonnell H. Stone, forester, in 1913. Remarkable success has been obtained in fire protection.

A statement issued by a representative of the Company is as follows:

"The Pfister and Vogel Land Company was organized as a Georgia corporation and began buying timber lands in the counties of Union and Towns in 1900, the main object being

Pfister and Vogel Land Company, Blairsville, has 65,000 Acres of Hardwood—Views of Yellow Poplar and White Oak Stands

a reserve supply of extract wood for tannin materials. When some 85,000 acres had been acquired, a sale was made to the United States in 1914 of approximately 19,000 acres, or all that part of the tract lying on the headwaters of Toccoa River in Union county where this watershed now comprises a part of the Cherokee National Forest. The remaining acreage owned by this company lies on the Notalee river watershed in Union county and on the Hiawassee river watershed in Towns county.

"The company employed a trained forester in 1913 and, following the sale to the United States, a definite policy of protection was established in 1915.

"A report made by timber cruisers had convinced the owners that 65 to 75 per cent of these lands were being burned annually, so the first lookout towers and telephone patrol system of the South were constructed on these lands in 1915-16, rangers and patrolmen being employed to direct the tenant-firewardens. A good tenant system was used instead of paid fire-fighters, and free range privileges were included in other concessions in order to secure cooperation in the prevention of forest fires. As a result of these methods, the average burned area per year has been less than one-tenth of one percent from 1915 to the present time (1930). The owners are satisfied with this work as a paying investment, and are convinced that values in new growth more than off-set the cost of protection and all carrying charges on the property."

COTTON MILL PRACTICES FORESTRY

The Chicopee Manufacturing Company, Chicopee, near Gainesville, owns 4,000 acres of mixed hardwood and pine forest. Work began on the forest in 1928 under the supervision of the Georgia Forest Service. Fire breaks have been established, thinning improvement cutting and planting are being practiced.

A statement concerning this project is as follows:

"The Chicopee Manufacturing Corporation purchased a tract of 3652 acres situated in Hall county, Georgia, three miles

southwest of Gainesville.

"The tract was acquired by the Chicopee Manufacturing Corporation to get sites for reservoirs for the water supply of the mill and mill village and to get control of the watershed draining into the reservoirs. The object in undertaking to

Chicopee Manufacturing Company Cotton Mills at Chicopee Has Largest Forest—Planting Crew at Work

practice forestry on the property is to protect the watershed from erosion, to secure a more regular stream flow, to create an attractive setting for the mill and village and to secure a maximum production of forest products.

"The area has been placed under intensive fire protection. A full-time forest and game warden has been employed and devotes his time to patrolling the area, and is responsible for protecting it from fire. A number of tenants and all employees of the corporation are instructed to report forest fires when discovered, and the area has been thoroughly posted with fire warning posters. A system of old roads throughout the entire area are kept open and maintained as fire breaks, and make the area accessible for fire suppression crews.

"Upon discovery of a forest fire suppression crews are promptly organized, equipped with suitable tools and transported to the scene of the fire. While the tract has suffered severely from fires in the past, less than 1 per cent of the area has been burned per annum during the two years the tract has been under protection.

"The forest is being improved by thinnings and improvement cuttings in which poorly formed and defective trees are removed. The material from these operations is used for fuel in the incinerator and in fire places.

"The area of old fields which are not restocking satisfactorily, or where gullies are forming, is being planted. A small nursery is maintained for the purpose of producing seedlings.

"The forest is managed under a plan prepared by the Georgia Forest Service and the forestry operations are conducted under the supervision of an assistant state forester."

PROFITS FROM NORTH GEORGIA UPLAND FOREST

J. M. Lindsey, Armuchee, in northwest Georgia, has found care and proper harvesting of forests pays on ridge land not suited for farming. He tells in the following statement of how he has obtained three crops from his land.

"In the year 1893 I bought two hundred acres of timberland covered with pine and hardwood near Armuchee, Georgia. I have practiced forestry after some fashion ever since I have owned it. The tract cost me $40.00 at that time. I took 150,000 board feet off of the tract, doing my own cutting, during the next three or four years. This was mostly a selection cutting. One instance of such a cutting was the price I was offered for one white oak tree taken off of the tract. I was offered $60.00 for this one tree.

"After ten years I sold the sawmill rights to an operator and made him cut to a diameter limit of 10 inches. The cut ran to 600,000 feet. This represents the second cut. Three years ago I sold the timber rights again and the operator cut 200,000 feet

from the tract.

"I have endeavored to keep fire out during my ownership of the land because I believe in timber protection in every way, and hope that with the cooperation of the Georgia Forest Service I can get better protection for my land in the future."

GROWTH RATE IN ABSENCE OF FIRE

D. H. Bennett, Gardi, has 6,800 acres of longleaf and slash pine which he is protecting from fire; thinning, employing improvement cutting, pruning and using good turpentine methods.

D. H. Bennett, Gardi, Has Protected Pines 20 Years Old Averaging 14 Inches in Diameter

He began protecting in 1917. Twenty-year old slash pine average 14 inches in diameter at 4 1-2 feet from the ground. He says:

"In reference to fire protection I am sure it will pay from my own experience, as I have protected some of my land from fire and some has been burned over regularly. The land that has not been burned over so often has more than twice as good tim-

ber as that on the land burned over regularly."

SATISFACTORY RESULTS FROM COOPERATIVE PROTECTION

Miles and Dunn, Baxley, with 5,000 acres of slash and longleaf pine, joined the Timber Protective Organization and are well pleased with results. J. R. Dunn says:

"For the last quarter of 1929 we operated our timber lands in cooperation with the State Forester, in cooperation also with the local Timber Protective Organization. Fire breaks have been constructed, patrol work done, etc., in an effort to protect our trees and make conditions better to produce more on the same lands.

"Our experience has been satisfactory. We have not had any fires even though our lands are in an area that has been used to more or less regular burning.

"In this county we have been helped and our requirements kept up with by our county agent, who acts as secretary of the local organization. We hope the county agents here and there will be active in this fine field of service."