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REPORT OF THE FORESTER.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., October 1, 1918.

SIR: I have the honor to transmit herewith a report of the work in the Forest Service for the fiscal year ended June 30, 1918.

Respectfully,

HENRY S. GRAVES,
Forester.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

THE FOREST SERVICE IN WAR TIMES.

The war has profoundly affected the Forest Service. It has opened new opportunities, presented new problems, and made some old problems more pressing. It has emphasized the value of the work of past years, which provided indispensable foundations for meeting vital needs in the present crucial time. It has also led to the temporary abandonment of many of the old lines of work, the curtailment of others, and the assumption of large new responsibilities. There have taken place, in consequence, a readjustment and in some fields a radical reorganization of activities.

The demands of the Army for fighting men, the eagerness of our personnel (most of whom are of age for military service) to respond to the country's call, the special need of the Army for men qualified to undertake tasks of an unusual character for which the work of the Service has afforded preparation, the call of war industries and essential industries for similar men, the inevitable drain on the personnel created by the opportunities for much more lucrative employment in outside work, and the necessity of maintaining an organization capable of carrying on the activities which must be maintained as a part of the war effort, have all had to be accepted and adjusted to each other. How this has been done, and to what extent the Forest Service is meeting its responsibilities with the Nation in arms, this report will seek to make clear.

Two great fields of work are involved. That which will first be dealt with concerns the National Forests. Integrally related as they are to the economic life of the country and to the production of necessities never before so urgently required as now, their continued administration along lines which would prevent the breakdown of any essential necessity was an obvious duty. No less was it a public duty to release for use elsewhere all the man power that could possibly be spared.

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The other important field of work concerns the best employment of the technical knowledge and equipment of the Forest Service for the furtherance of war preparations involving the use of forest products. The opportunities in this field have proved increasingly numerous and important. The demands of the Army, the Navy, and the war industries for assistance have been far beyond the capacity of the Forest Service to meet. In order to come as near as possible to meeting them, every available man has been taken from other work. All lines of investigation not concerned with war problems have been halted. The resources thus made available have been augmented by funds obtained from the War and Navy Departments. The entire energies of the Forest Service are now devoted to prosecuting the National Forest enterprise, as an essential war-time activity, and to aiding in the most advantageous employment of the country's forest resources generally for the winning of the war.

THE NATIONAL FORESTS.

RECEIPTS AND OPERATING EXPENSES.

The receipts from the National Forests in the fiscal year 1918 totaled $3,574,930.07, an increase over 1917 of $117,961.66.

While the grazing business produced an increase over 1917 of $176,027.18, the timber business showed a falling off of $58,965.79. In both cases war conditions were primarily responsible. For the sake of greater production of meat, hides, and wool the number of live stock permitted to graze on the forests was raised to the highest limit consistent with safety. On the other hand, the receipts from National Forest timber fell off because of the labor and transportation difficulties which confronted the operators in the Northwest, where the sales are heaviest.

The operating expenses of the National Forests have been for several years practically stationary at approximately $4,000,000. These include only the cost of maintaining the regular protective system. Emergency fire conditions are met, if they arise, first by the use of the special emergency appropriation of $150,000 and then, if this is not sufficient, by seeking deficiency appropriations from Congress. In the last eight years it has been necessary to seek from Congress four deficiency appropriations, aggregating $2,081,543, while in three of the remaining four years the $150,000 emergency item carried in the regular appropriations was supplemented by a second emergency fund which made available $1,000,000 in 1912 and $200,000 in 1913 and 1914. The total emergency expenditures for protection in these eight years have been nearly $3,800,000.

It is becoming very plain that the present methods of protecting the great bodies of heavy timber in the most inaccessible regions should be modified. Not enough is spent on the regular protective system, and in consequence large emergency expenditures become necessary. To the cost of fighting the fires must be added the property losses which they inflict. The receipts from the forests are now not far below the operating expenses, and but for the disturbed conditions due to the war would unquestionably exceed them. With enlarged provision for maintaining the regular protective system the emergency expenditures to put out serious fires could be reduced

to a much lower level. It would be far wiser to put the funds which it is necessary to seek from Congress in the form of deficiency appropriations into the cost of keeping fires from becoming serious, through greater outlays for fire prevention, early detection, and swift concentration of fire-fighting forces. This subject is discussed in further detail under the subject of "Protection."

THE PERSONNEL SITUATION.

While private enterprises have had to accept increased operating costs as a result of the rise in the wage scale and in the price of materials due to the war, the regular expenditures of the Forest Service have perforce been limited to the amount appropriated by Congress. The weight of the burden has fallen largely on the personnel; with conspicuous and devoted loyalty the bulk of our force, outside of those who have gone into the Army or Navy, have chosen to stand by the Service, although they might almost to a man have obtained much better-paying positions elsewhere. This can not continue indefinitely, nor is it right that it should. The National Forest force is now underpaid, and its members are hard pressed by high living costs. Without relief, the standards of administration and protection are bound to deteriorate greatly and rapidly. Instead of being allowed to deteriorate they should be raised.

Even before the war the statutory salaries of a large part of the National Forest force were below what men of the same caliber and experience could readily obtain in private employ. That the turnover has not been larger has been partly because the work itself, with its opportunities for rendering real and valuable public service and the prestige and position of local leadership afforded, has appealed to many men as partial compensation for the relatively low pay. There has also been the hope and expectation that, with reasonable time, the Forest Service would be able to give promotions which would do justice to faithful and capable men. Further, the Service has been fortunate in the possession of an *espirit de corps* which has done much to hold its force together.

Nevertheless, in the last few years it has been increasingly difficult to keep the men. Restiveness in the face of increased costs of living and a wage scale based on the standards of eight years ago has tended to develop. In certain classes of positions particularly, the Service has been almost a training school through which men have passed to better-paying private employment. In general, the more responsible positions are filled by men who entered the Service when it was a young and rapidly expanding organization, and when they themselves were young and unencumbered with family responsibilities. Conscious that they have become more valuable with maturity and experience, and confronted with the necessity of providing for growing families, it is natural that many should turn to employment elsewhere when it begins to appear to them that their prospects of material advancement in the Service are doubtful.

This personnel situation has been much aggravated by the recent upward leap of living expenses and the great demand for men to fill outside positions which have resulted from the war. Local studies indicate that the cost of living has risen since 1914 approximately 60 per cent. Food supplies and clothing have in some localities

doubled and even more. The rise has been especially marked in the last two years. The forest ranger receiving $1,100 or $1,200, required as he is to own from one to three horses, finds himself, even with the greatest economy, unable to pay his essential bills. By taking work in the mines, shipyards, sawmills, or with live-stock companies he can do much better. The bulk of the men have remained at their posts, though scores have received outside offers of from $200 to $2,000 or more per year in excess of their Forest Service salaries.

The situation of the forest officers, clerks, and others having fixed bases of salary is very critical, and requires the earnest consideration of Congress. It has so far been possible to meet the drain upon the personnel by readjustments, by curtailment of certain work, and by employing as temporaries persons less skilled and experienced. The consequences have necessarily been felt at some points. It has not always been possible to maintain the same standards of service, and some constructive work of public importance has had to be given up. One instance occurred in 1917 on a Forest in Idaho. Practically the entire forest force had been replaced by relatively inexperienced men. It cost $50,000 to put out fires that normally would have been quickly brought under control; and there was also a loss, in timber destroyed or damaged, of $40,000.

The Forest Service has furnished to all branches of the Army and Navy 446 men. In addition to this a considerable number have left to serve in the War and Navy Departments in a civil capacity, and still others have resigned to take part in industries directly concerned in producing materials for war uses. Still others have been forced to leave the service because, with the low standard of salaries, they were unable to meet the constantly increasing cost of living. Since our entry into the war 1,179 persons, including those who have gone into the Army and Navy, have left the service. The reduction of the trained force by transfer to other branches of the Government for military work has constituted the normal contribution to the war. That practically the whole force did not enter such work has been due to the courageous patriotism of the men in remaining at their posts because requested to do so on account of the necessity to protect the public forests and maintain their essential activities.

One of the first calls made upon the personnel was in connection with the organization of the forestry troops by the Corps of Engineers. Two regiments of skilled woods and sawmill workers, comprising about 9,000 men and fully equipped with sawmills and logging appliances, were sent to France to produce from the French forests wood materials needed by the Army. The Forester was sent to France under commission to prepare the way for this work, and the Forest Service was called upon to cooperate in the recruiting of the forces. Altogether over 150 members of the Forest Service were taken for these forest regiments.

THE NATIONAL FOREST PROPERTIES.

CONTINUED DECREASE IN AREA.

The net area of the National Forests at the close of the fiscal year was 155,374,602 acres, as against 155,166,619 acres one year previously. The corresponding gross areas were 175,951,266 acres and

176,253,160 acres. Gross area includes all lands within the National Forest boundaries; net area excludes alienated lands.

On the face of these figures, an increase took place in the net area. This is much more than accounted for by the fact that in 1918 four National Forests—the Alabama, Shenandoah, Natural Bridge, and White Mountain—were proclaimed. These four Forests had a total area of 730,894 acres. Their proclamation, however, merely gave formal status as National Forests to lands already under administration and National Forests in everything but the name. They were four of the so-called "Purchase Areas" established in connection with the acquisition of lands for National Forest purposes under the Weeks Law.

In all, five of the Purchase Areas have become National Forests through presidential proclamation, the Pisgah having been proclaimed in the fiscal year 1917. All the Purchase Areas, however, are now under a form of administration identical with that of the National Forests. Since no change whatever accompanies or follows the formality of proclamation, the apparent net area increase due to this cause is obviously without significance. The real situation is more accurately expressed if all the Purchase Areas are included as National Forests. The statement then becomes:

Area of National Forests, including purchase areas.

Date.	Gross area.	Net area.
	Acres.	*Acres.*
June 30, 1918	176,504,232	155,927,568
June 30, 1917	177,145,548	156,060,007

In these figures the gross and net areas of the Purchase Areas are treated as identical. The Purchase Areas comprise (1) lands title to which has actually passed to the Government, amounting at the close of the year to 1,132,792 acres; (2) lands approved for purchase by the National Forest Reservation Commission and under process of acquisition, amounting to 509,011 acres; and (3) private lands which may or may not eventually be approved for purchase, amounting, as the boundaries are now drawn, to 4,646,435 acres. The boundaries of the Purchase Areas, however, are not strictly comparable with those of the western National Forests, which are fixed by presidential proclamation. They are tentative limits within which the commission will consider making purchases and may be modified at any time, and at present include much more private land than public. Hence in making up the above figures the Purchase Areas are regarded as including only the lands which have been actually acquired.

Prior to the fiscal year 1917 each successive year since 1909 showed a decrease in both gross and net areas. Compared with the total area when the Forests were at their maximum, early in 1910, the 1918 figures given above show a decline of about 18,000,000 acres gross and 16,000,000 net. This cutting down of the Forest areas has resulted chiefly from land classification. After nine years of steady sifting to separate from the Forests such lands as should not be permanently retained in public ownership, the task has, except in

Alaska, been brought substantially to completion. The existing Forests are approaching stability.

REASONS FOR DECREASE IN AREA.

The land classification idea lay behind the establishment of the Forests, but at first it had to be applied in a rough and ready way. The forested public lands were passing rapidly into private ownership, and there was no time for a refined classification. Hence the first decade of the twentieth century was the period of rapid area expansion, while close to another decade has been given to restudying the lands in order to determine just how much should be permanently held.

The act of June 4, 1897, after defining the purposes for which National Forests might be established, specified two classes of land which were not to be permanently retained, and provided for their disposition. Recognizing that the temporary inclusion of a certain amount of land more valuable for agricultural or mining development than for Forest purposes would necessarily attend the making of the reservations, the law authorized the Secretary of the Interior to restore such lands to the public domain "after due examination by personal inspection of a competent person appointed for that purpose." It also made mineral lands subject to continued location and entry. The act of June 11, 1906, authorized opening to entry lands within the Forests found to be chiefly valuable for agriculture. Study of the situation soon disclosed, however, that portions of the Forests should be eliminated for other reasons. A good deal of land had been included which, as its potential usefulness was weighed, was found unsuitable for National Forest purposes because its value to the public was too low to justify the cost of administration. In many other cases the Government-owned lands were too heavily interspersed with private holdings for advantageous administration. The bulk of the lands which have been eliminated from the Forests since 1909 fall within these last two classes.

While much of the area thus eliminated has agricultural value, as a rule the agricultural value, where there was any, was low. A relatively minor amount of agricultural land of excellent quality, usually in strips along the valleys of the larger streams, has been eliminated, while the forest homestead act has made it possible to deal with small patches of lands chiefly valuable for agriculture by listing them for entry as interior holdings. In the case of lands chiefly valuable for the minerals therein it has not been found necessary to provide for their development through eliminations, since the Forests are open to prospecting and mining development precisely as are the public lands. When a mining claim goes to patent the land is thereby classified as mineral, and this means of securing the development of such lands is all that is needed.

One other important class of land remains to be mentioned. As the National Parks policy has developed it has become evident that some portions of the National Forests have their highest value for permanent administration by the Government as National Parks. Some of the reduction of the area of the National Forests has been due to the enactment of legislation creating National Parks out of National Forest lands. The desirability of this course, where the

character of the attractions is such that administration of the lands as National Parks will result in their highest use, has been fully recognized by the Forest Service. Establishment of the fact that the highest use of the land will be secured by making it a National Park is in effect another form of land classification.

The reasons, then, for the reductions in area have been:

(1) To cut out of the Forests, through boundary changes, lands not important for National Forest purposes.

(2) To cut out, also through boundary changes, lands which could not in practice be successfully administered because of the large percentage of intermixed private holdings.

(3) To open to agricultural settlement lands which, although valuable for National Forest purposes, will serve their highest use as farms. This has been accomplished partly through boundary changes, but mainly through listing for settlement as interior holdings.

(4) To open to mineral development lands chiefly valuable for this purpose. This is brought about by the operation of the laws under which the Forests are open to prospecting and the locating and patenting of mineral claims.

(5) To make National Parks.

Underlying all of these reasons is the basic principle of determining the highest use to which the land can be put.

Such a determination is necessary to a right classification of the land. It can be made only in the light of a careful study of the potential value of the land for various specific purposes. To determine that it is chiefly valuable for forest purposes involves knowledge not only of what value it has for other purposes but also of the kind of use it will serve, and the public value of this use, under National Forest administration. Value for watershed protection, for timber production, for grazing, for recreation, for water-power development, and for various incidental uses must all be taken into account. Correct principles of land classification and a right application of these principles in dealing with specific areas are basic to successful development of the Forest properties.

PRESENT STATUS OF LAND CLASSIFICATION.

In the six years that have elapsed since the first special appropriation item for land classification became available, 150,579,380 acres have been covered by field examinations and the results embodied in reports and maps which have been submitted to and approved by the Secretary of Agriculture. Excluding the lands purchased under the Weeks Law and not subject to agricultural classification and homestead entry, the lands still unclassified total 24,609,499 acres, of which 21,013,205 are in Alaska. Of the 3,596,194 acres outside of Alaska still remaining unclassified more than 2,500,000 acres are in California. Much of the field work on all the lands still remaining unclassified has been completed and maps and reports embodying the results were in course of preparation at the close of the year. Before the close of the current year it is expected that the work will have been brought to substantial completion, except for the two National Forests in Alaska.

On these two Forests work was begun last year. In the Chugach it resulted in approval by the Secretary of Agriculture of the elimi-

nation of 307,800 acres, which will dispose of the chief agricultural land problem in the National Forests of Alaska. The proclamation making this elimination awaits final action in the Interior Department before its transmittal to the President.

ELIMINATIONS MADE DURING THE YEAR.

Eliminations totaling 894,077 acres were made during the year by presidential proclamations or Executive orders from 13 National Forests. At the close of the year there were pending in the Interior Department proclamations providing for the elimination of 1,016,923 acres more.

There was also eliminated, through final approval by the Interior Department, 133,235 acres of State selections in the Kaniksu Forest and 5 acres in the Harney Forest. These eliminations were due to land exchanges with the States of Idaho and South Dakota.

An apparent reduction of 129,082 acres resulted from recomputations of the area of a number of Forests, disclosing errors in the figures previously reported.

ADDITIONS DURING THE YEAR.

Hand in hand with the cutting down of the Forests, a movement in the opposite direction has taken place. It has the same basic purpose—to provide for the highest use of the land. Established as the National Forests were and had to be, without close study of the best boundaries or waiting for a mature decision as to just what classes of land would eventually prove suitable for permanent administration, they left outside in many cases areas of public land the addition of which is equally desirable with the elimination of unsuitable lands. Further, it is now fully recognized that the Government should extend its holdings through the acquisition of private lands.

New lands are added through (1) presidential proclamations incorporating in the Forests suitable areas of public lands, in the States in which Congress has not prohibited further action of this character; (2) acts of Congress, also making additions from the public lands; (3) purchases, under the Weeks Law; and (4) land exchanges.

In addition to the proclamations already mentioned which established the Alabama, Shenandoah, White Mountain, and Natural Bridge Forests from lands already acquired and under administration as purchase areas, three proclamations were issued making additions to the Forests from the public domain. The total area thus added was 93,017 acres.

No additions to the National Forest areas were made by act of Congress during the year.

The purchase of 185,199 acres under the Weeks Law was approved by the National Forest Reservation Commission during the year. Of this, 997 acres are in Arkansas. The extension of purchases to that State marks a new departure; previous action had been confined to the White Mountain and Southern Appalachian regions. The lands to which title was actually acquired totaled 171,940 acres. There remains available for purchases under the Weeks Law nearly $1,000,000.

Because of the war, acquisition of new lands has been temporarily suspended except for lands already approved by the commission or

for lands which block in with earlier acquisitions. The results already obtained through administration of the purchased areas, however, and the signal demonstration that has been made of the ability of the Government to obtain on favorable terms lands public ownership of which is advantageous, not only for the protection of navigable streams but also, and at the same time, for other National Forest purposes, point to the importance of a renewal of the forward movement when the war is over.

Exchanges of land are primarily for the purpose of consolidating the holdings of the Government. They can be made only as authorized by specific acts of Congress. Hitherto exchanges have been principally for State school lands. The first exchanges made were on the basis of equal area and value. Subsequently exchanges were provided for on a basis solely of equal value. Such exchanges as a rule result in an increase of acreage. Finally, the act authorizing exchanges on the Whitman Forest has provided for obtaining title to private lands whose owners take in return for the lands surrendered an equal value of National Forest timber. As the exchange policy already embodied in legislation is more widely applied considerable increases of the National Forest area from this source are probable.

On the whole, the movement for additions to the Forests is evidently growing stronger. This is due primarily to the demonstration of the public advantages realized through Government ownership and administration of the present Forests. The movement for establishing the Forests which culminated in 1909 preceded such a demonstration. It was checked because of the very natural doubt as to how the system would work in the long run, and because of strong Western opposition to what it was feared would prove an incubus upon local development. Because the western public has become convinced through actual experience that the Forests are not detrimental but beneficial to local development, a rising tide of public sentiment in favor of additions to the Forests is now beginning to make itself strongly felt. Evidence of this is recorded by the attempts made to secure additions through acts of Congress, in the seven States in which presidential additions are prohibited. A number of acts have been passed making such additions.

At first the primary purpose for which such legislation was sought was watershed protection; but it was not long before projects for a large number of additions were advocated for the sake of the benefit of range regulation. Toward such additions, both in the excepted States and in those where the President may still act, the position of the Forest Service has been that, where Government ownership and administration of range lands not valuable for timber production or water protection is desirable, legislation specifically authorizing administration for range control should precede. One such act is now before Congress. In the State of Nevada alone projects for proposed additions of grazing lands covering over 10,000,000 acres have been adversely reported on by the Forest Service in the absence of direct legislative sanction for including grazing lands as such in the National Forests. Unquestionably, the movement for adding grazing lands to the Forests would have gained much greater headway had it not been held in check by the unwillingness of the Service to give

its support to proposals of this character in the absence of explicit legislative authority for such a course. Further, it is not believed that the public-lands grazing problem can be solved in this way. Adding individual areas to National Forests would be at the best only piecemeal disposition of a great problem which should be handled through general legislation.

Of late, new impetus has been given to the movement for additions by the growing realization of the all-round value of the Forests as factors in promoting local development. Perhaps no better illustration of this can be found than the memorial of the State of Idaho to Congress, passed by a practically unanimous vote of both houses of the State legislature, for the inclusion in the National Forests of what is known as the "Thunder Mountain Country." This memorial recites that the Thunder Mountain Country consists of approximately 1,120,000 acres of unreserved and unappropriated public land, of which not to exceed 1 per cent is agricultural in character; that nearly 350,000 acres has been swept by forest fires during the last 12 years, destroying approximately 700,000,000 feet of timber; that the mineral and water possibilities of the region are lying dormant and unproductive; that the wild life is being exterminated; that the grazing lands are being devastated by nomadic herds; and that the area is contributing little or nothing to the support of the county or State government or to the wealth of the surrounding communities. It then continues:

> The inclusion of the said area within a National Forest would eliminate the annual destruction of timber by forest fires; make it possible for homestead settlers to secure title to their lands under the forest homestead act of June 11, 1906, without expense to them other than entry and final proof fees and without the necessity of awaiting public land surveys; would bring Federal aid in the construction of wagon roads, trails, bridges, and telephone lines; give adequate protection to the game animals, birds, and fish; establish a system of regulated range use, thus conserving and perpetuating the forage resources for the benefit of the local residents and taxpayers; make it possible for the State to realize upon its equity in the lands by relinquishing the unsurveyed school lands (secs. 16 and 36) and selecting more valuable lands elsewhere; increase the revenues of the county and State through the receipt of 35 per cent of the gross receipts collected by the Forest Service; enlarge the power of the State to share in the benefits of the Federal aid road act; and otherwise assist in opening to development and use the vast material resources of the Thunder Mountain region.

This addition should unquestionably be made.

PROTECTION.

Ever since administration of the National Forests began their protection against fire has been the greatest single problem confronted. Great progress has been made; effective methods of preventing, detecting, and suppressing fires have been developed; and yet the problem is by no means solved. On the contrary, it still remains the most difficult and perplexing of all administrative problems.

This is because of the peculiar conditions which make application of the system of fire control to the regions where fires are most dangerous a question of expediency in the use of limited funds and the choice of objectives. In other regions the protective system is adequate for satisfactory results because the development of improvements has progressed to a point which gives practically full

control. But where the country is still an utter wilderness, with scanty means of communication, no local population, and supply centers far away, quick action to put out fires before they gain headway is very difficult and the fighting of large fires very expensive. War conditions have introduced new elements into the situation and have increased the need for a restudy of the whole problem.

A disproportionately large fraction of the fire-fighting funds is spent on a few heavily timbered Forests in Montana, Idaho, Washington, and Oregon. The country is very rugged and mountainous, the number of lightning-set fires high, the climatic conditions such as to produce frequent seasons of great exposure to fires, and the character of the timber-growth favorable to their wide spread. Unchecked, fires in these Forests would do enormous damage. The National Forests in these four States have 37 per cent of the entire National Forest acreage, and 52 per cent of all the merchantable timber; but their fire-fighting costs in the four bad years 1910, 1914, 1915, and 1917 were 83 per cent of the total for all the Forests. Of this 83 per cent, four-fifths was expended on 20 of the 65 Forests in the four States, and two-fifths on a group of 7 adjacent Forests in which the situation is especially difficult.

These disproportionate expenditures are due chiefly to the frequency with which the fires reach so great a size that scores or hundreds of men must be gathered, transported, equipped, and maintained for days and even weeks on the fire lines, far within the Forests. The greatest fire hazard is in northern Idaho and western Montana, where immense resources remote from transportation and not now in demand are being held and protected for future use in the industries and development of the country. Here we still have almost a wilderness, with very few settlers in the forested areas and few men employed except in the lumbering and mining activities close to lines of transportation. There are wagon roads into only a very small proportion of the area and the system of trails is as yet incomplete.

This means that in the event of a forest fire too large to be successfully handled by the fire patrolmen stationed in the district, help can be secured only from distant points, and equipment and supplies must be packed in to the vicinity of the fire. Under such conditions the shortest time in which an adequate crew with equipment and supplies can be secured and got on the ground may be from five to seven days. By that time the fire may have spread, with unfavorable weather conditions, to such proportions that second and third calls for help are necessary before it can be brought under control.

Also, the incomplete system of roads and trails greatly increases the difficulty of quick movement when changes in the point of attack become necessary, and the lack of such facilities is often mainly responsible for inability to extinguish fires quickly and for a consequent large property loss.

The recruiting of large forces of fire fighters necessarily takes labor from productive industries, and their maintenance involves the consumption of supplies thus withdrawn from other use. As the war goes on it becomes more and more important to conserve both labor and supplies. War wages and war prices also heavily increase the Government's fire-fighting bills. It was difficult last summer to get

labor for the fire lines, and it will doubtless be much more difficult next summer. There is every reason for adopting, wherever possible, protective methods which will lessen the emergency occasions.

This danger can be lessened by increasing the regular protective force and putting it in the field earlier in the season. Last summer exceptionally early drought brought on a fire season of abnormal severity before the protective force was ready for it. Roads, trails, and telephone lines were still in process of repair to fit them for use again after the winter storms. The summer force of lookout men, patrolmen, and smoke-chasers was not fully organized and placed. While putting the protective force in the field earlier involves an increased expenditure in all years, in order to be ready for the exceptional years, the men can always be well employed, first in the repair and then in the construction of improvements.

With the present labor situation and need to avoid in every possible way the diversion of labor from those activities which are essential to winning the war, it seems a public duty to provide for placing an increased force of fire patrolmen on the Forests in sparsely settled districts, so that the need for drawing from labor engaged on other activities the men needed for emergency fire fighting may be reduced to a minimum. To do this will require an increased initial expenditure for patrolmen but in the long run it will result not only in a decreased expenditure for emergency fire fighting but also in a large decrease in the damage to the Forests and a big saving in man power.

Still more important is a recognition of the fact that the Forests can not be economically and efficiently protected against fires until they are well equipped with roads, trails, telephone lines, and lookout stations. Construction crews can be so distributed on the Forests and their work so timed that when fires break out they can readily be thrown into the fight. By attacking the fire problem, in the regions where it is most acute, along such lines as these it is believed that both the emergency expenditures and the use of man power can be materially cut down.

Both in 1917 and in 1918 exceptionally severe fire conditions had to be met. The first half of the calendar year 1917 was most favorable, but shortly after July 1 the situation changed rapidly. The usual summer rains failed, and a fire season developed which put the protective force of the Service to one of its severest tests. A deficiency appropriation of $775,000 was necessary to meet the emergency expenditures.

The fire menace prevailed throughout the entire West, but, as in 1910, the worst fires were in the heavily timbered and sparsely settled Forests of northern Idaho and western Montana. In Montana the rainfall during the summer months was less than in any other year of record, and in Idaho it was less than in any other year except 1893 and 1910. Similar weather conditions prevailed in Oregon and Washington, and the fire hazard there was the worst since 1910.

In number, the fires of 1917 exceeded those of 1910, but the area burned over was only 749,377 acres, as compared with more than four million acres in 1910, and the estimated damage to the National Forests was only $1,358,627, as compared with more than twenty-five million in 1910. This was due partly to the fact that the winds were

less violent, partly to improved organization and means of detecting and reaching the fires.

The following table gives further statistics regarding the 1917 fires. The largest proportionate increase over the previous year was in fires caused by railroads and lightning. This was due almost entirely to the extremely dry condition of the Forests and the consequent ease with which locomotive sparks and electrical storms started fires.

Fires on National Forests, calendar year 1917.

Extent and causes of fires.	Number of fires.	Percentage of total.
Area burned over:		
Under 0.25 acre	3,130	40.05
Between 0.25 acre and 10 acres	2,197	28.12
10 acres and over, damage under $100	1,893	24.23
10 acres and over, damage $100 to $1,000	415	5.31
10 acres and over, damage over $1,000	179	2.29
Total	7,814	100.00
Causes of fires:		
Railroads	1,003	12.84
Lightning	2,132	27.28
Incendiary	952	12.18
Brush burning	557	7.13
Campers	1,288	16.48
Lumbering	193	2.47
Unknown	1,365	17.47
Miscellaneous	324	4.15
Total	7,814	100.00

In the calendar year 1918 the fire situation has been critical from the very beginning of the season. An unusual drought prevailed in Arizona, New Mexico, eastern Oregon and Washington, northern Idaho, and western Montana. Ordinarily there is little danger in the Northwest prior to June 15, and the employment of many of the regular summer patrolmen begins on that date. In 1918, however, a serious fire, the extinguishment of which required an extra force of 250 fire fighters, started on the Coeur d'Alene Forest on June 10, before the regular patrolmen were on the ground. An equally bad situation developed in Arizona and New Mexico early in the summer, which required the employment of a large number of extra fire fighters during the month of June. With the funds depleted by an unusually bad fire situation during the last half of the previous calendar year, it became necessary to abandon many important projects, including planting and improvement work, in order that the money might be used for fire fighting.

The fiscal year closed with the fire situation exceedingly critical. Many dangerous fires were burning in the Forests of the Northwest, and an extra force of fully 500 fire fighters was engaged in fighting them. The fact that the agricultural appropriation bill had not passed, and the limitation of expenditures under the continuing resolution of Congress to one-twelfth of the previous annual appropriation per month, made it impossible to finance the fire-protection work in the usual way. In this emergency the President of the United States, at the request of the Secretary of Agriculture, made available $1,000,000 from the national security and defense fund, it being

understood that a deficiency estimate will be presented to Congress for reimbursement of the amount actually expended. The cost of emergency fire fighting up to September 1 had reached the sum of $575,000, with conditions still dangerous in several localities. It is therefore probable that a deficiency appropriation of at least $750,000 will be required to cover the expenditures.

Observation indicates that the active educational campaign which has been carried on during recent years has brought the public to a realization of the importance of exercising the greatest care in the use of fire within both public and private forests, and that the number of fires caused by human agencies is being reduced. Although in a season like the last two a great many fires are bound to occur, it is a fact that the proportionate number of fires in the more thickly populated regions is gradually being reduced.

Cooperation with the different States under the special appropriation for that purpose, and with cities, counties, and the various fire-protective organizations, has clearly proved that fire fighting is war against a common enemy in which success is dependent upon a coordination of all the combatant forces. Most encouraging progress has been made in cooperative work. For example, in the State of California, through cooperation with the University of California, 412 local fire-fighting companies have been organized; 532 fire trailers, equipped with fire extinguishers or fire-fighting tools, have been installed at danger points; and 6,500 individuals are members of the rural fire-fighting companies. Similar results are being accomplished in other thickly populated regions.

An important form of protection of the National Forests is the prevention of loss from destructive insects and from tree diseases. Losses from these causes are great in the aggregate, although timber is seldom killed in large bodies. The largest and most valuable timber, which having reached maturity has less power of resistance than thrifty young trees, is most likely to be affected.

The Forest Service, in so far as the funds at its disposal will permit, has been conducting control measures in the more important areas of severe insect infestation, basing its activities on the technical studies conducted by the Bureau of Entomology. Uncertainties in regard to funds make it impossible to conduct work in every case on infestations at the time when the work would be most effective. The situation is often similar to that in the case of a forest fire, since a relatively small amount of work done while an insect infestation is small may prevent both a much heavier expenditure later, when the attack has grown to larger proportions, and a serious loss of valuable timber.

The importance of insect-control work is illustrated by the results of a study made in California in cooperation with the Bureau of Entomology and certain private owners of timberland. This study indicated that there is an annual loss of timber to the value of between $200,000 and $300,000 in this State alone as the result of insect infestation. It also indicated the areas which were most in need of control measures, and formed the basis for the work done in the spring of 1918 in cooperation with the National Park Service and the Bureau of Entomology. At the close of the fiscal year it was

evident that control measures should be continued in California, and also that there were infestations in parts of Oregon, Montana, and New Mexico, any one of which might develop into serious epidemics. These infestations are being closely watched.

MANAGEMENT.

TIMBER.

The lumber industry has been handicapped by the withdrawal of many of its skilled laborers for active participation in the war. The scarcity of experienced labor has been general. In some regions operators have been able to maintain or even to increase their production by using inexperienced labor in larger numbers than formerly; but the total cut of lumber in the country decreased about 10 per cent in the calendar year 1917 as compared with that in 1916. In spite of the marked decrease in general construction work, the demand for lumber for war uses has furnished a strong market to the operators and has enabled them to dispose of almost any material they could produce with the available labor.

This general condition reacted on the timber sale business of the National Forests to a less extent than might be expected. The total amount of timber cut in sales on the National Forests was slightly larger than in the previous fiscal year. Sharp decreases occurred in the cut on some Forests in regions where labor was most difficult to secure or where making the product involved the use of large numbers of laborers. These decreases, however, were offset by increased cuts in other regions where labor, though inexperienced, was abundant or where the most urgently needed war material could be produced. The more notable decreases were on the National Forests in Montana and Idaho, where labor was extremely difficult to secure; the greatest increases were in California, Arizona, and Colorado.

In a few sales the operations were suspended or greatly reduced. In one case all the officers of the purchasing company entered military service, and logging ceased. Some hewed-tie operators were able to secure so little labor that only a small fraction of the normal output could be cut. On the other hand, operators producing ship timbers, airplane lumber, box lumber, and sawed ties did their utmost to increase output of these products to replace the slackening demand for finishing and general construction lumber.

The amount of timber sold decreased sharply. Restrictions on the use of capital for development work, such as the construction of expensive logging railroads, prevented negotiations for the sale of large bodies of timber remote from existing transportation. Uncertainties in regard to future markets and labor supply led operators to be very cautious in undertaking long-term contracts, and there was a still more marked hesitation on the part of small operators who normally sell their entire output of logs or lumber under annual agreements. At the close of the fiscal year very few large sales were being negotiated, but a steady demand existed for small, fairly accessible bodies of timber, especially to meet the local needs of communities near the National Forests.

The timber resources of the Forests have been drawn on for a wide variety of products needed in the war activities of the Nation.

Sales of spruce and of other species suitable for use in airplane construction have been made with the object of meeting a specific war need, as have also sales of wood and bark from which tannic acid is extracted to be used in tanning leather for war needs. Sales of hewed ties, mine timbers, telephone poles, and other special products have helped to maintain the country's transportation facilities and production of fuel and metals. In a few cases it has been possible to furnish fuel needed at army camps, to be cut either by the army or by contractors. It is impossible to determine the proportion of the total cut on the National Forests which was ultimately used in war activities, but since the lumber industry has been very largely dependent for its market upon direct or indirect war orders, a large part of the cut on the National Forests unquestionably was so used. The total output of some sales, such as those of airplane material, was, of course, delivered to the Government. Even with purchasers who before the war produced construction lumber for the general market, it is probable that from 30 to 60 per cent of the output during the last year was sold directly or indirectly for use in the war program.

The Forest Service, in cooperation with the Bureau of Aircraft Production, has endeavored to stimulate the production of airplane lumber from Sitka spruce in every way possible. This species, however, occurs in commercial quantities on only a few National Forests, including the Olympic National Forest in Washington, the Tongass Forest in Alaska, and the Siuslaw Forest in Oregon. Every opportunity to purchase stumpage on these Forests was offered to operators, and a number of sales were made, aggregating over 40,000,000 board feet. Most of the spruce, however, is remote from transportation, although this situation will be somewhat relieved with the extension by the Government of the railroad along the north and west sides of the Olympic Peninsula. Some of the airplane lumber which was produced on the Olympic Forest was hauled to the railroad by motor trucks over distances as great as 30 miles. In Alaska the quality of the timber proved to be inferior to that in Washington, and although some satisfactory material for use in airplanes has been produced, it is now known that the best opportunities for production are in the State of Washington. The greater portion of the best spruce is in private ownership, as is also nearly all of the Port Orford cedar, of which two small sales for airplane lumber production were made on the Siskiyou Forest.

The agricultural appropriation bill for the fiscal year ending June 30, 1919, contains special provision for the granting of timber on the National Forests to any department, board, or committee of the Federal Government if the timber is to be used for war purposes. This legislation will enable a wider use of the timber resources of the Forests to be made in the prosecution of the war. Every opportunity for the effective use of this legislation will be made.

The sale of timber at cost of administration to settlers and farmers under the act of August 12, 1912, and the free use of timber resulted in the cutting of nearly the same amounts as in previous years. More settlers and farmers took advantage of the opportunity to purchase at cost than ever before, over 5,900 sales being made.

cents per pound for each steer sold and 10 cents per pound for each lamb this gain was worth over $1,162,500. The total grazing fees paid amounted to $52,258, which includes also grazing fees on the cows, ewes, and younger animals not sold. The actual gain in meat alone was over twelve million pounds, not considering the wool growth.

On the Ashley Forest, in Utah, the owners of a large number of cattle of all ages estimated that the animals gained an average of 300 pounds each during the period in which they used the Forest range. The grazing fee was 31 cents per head.

The carrying capacity of some of the Forests is very large. For the season of 1918 the Humboldt in Nevada, with 58,853 cattle and over 350,000 sheep, heads the list. The Sawtooth in Idaho carries over 300,000 sheep, the Caribou in the same State over 281,000, and the Rio Grande in Colorado 284,000. The Tonto Forest in Arizona furnishes grass for over 70,000 cattle and the Prescott in the same State finds room for over 61,000, with more than 68,000 sheep to keep them company. The capacity of the Arizona Forests is the more remarkable in that they are yearlong ranges, the cattle remaining upon them throughout the year.

Ten years ago the number of wild, unclaimed horses on many of the Forests constituted a menace to the other and more valuable stock, especially cattle. Horses are more injurious to ranges than any other class of live stock because of their manner of traveling on the ranges and the fact that they graze much closer than cattle, or even sheep. For a time the demand for a certain class of light horses resulted in the gathering and shipment of a large number of these animals. In recent years, however, this demand has almost ceased, their numbers have increased, and they are again becoming a pest on certain well-stocked Forests. Where water is scarce they drink from tanks and reservoirs badly needed by the cattle, while they make heavy inroads upon salt, fighting cattle away from the salt troughs and often injuring the calves and weaker cattle in their mad rushes from the salt grounds on the approach of mounted men. Many of these bands of horses are unbranded and have no actual owners, although "maverickers" operate among them constantly, thus keeping the animals on the move, disturbing the cattle, and injuring the range. Many are so wild as to make it difficult to round them up, except at heavy and almost prohibitive costs.

The ranges used by these range outlaws is badly needed for the use of cattle, whose value is far beyond that of the horses; and on several Forests it has been deemed advisable to refuse to issue further permits for grazing this class of stock, thus compelling the owners to remove from the Forest ranges those that can be gathered. By this means it is hoped gradually to reduce the number of wild horses very decidedly, and through the organization of special roundup parties, with the sole object of gathering and shipping the wild ones out of the country, they will ultimately all be moved and the range saved for the use of stock of higher economic value.

In several parts of the Southwest, notably in some of the Arizona Forests and in the Grand Canyon National Monument, the increase of wild burros is a serious problem on the ranges. These animals are

owned by nobody and are even more difficult to capture and handle than the wild horses.

The shipment of sheep to and from the Forest ranges is now becoming more and more frequent. This has been forced upon sheep owners, owing to the rapid settlement of the open ranges adjoining the Forests and across which they have been heretofore accustomed to drive to and from the Forests in the spring and fall. From the standpoint of conditions within the Forests, shipping is very desirable. Upon many of the driveways established across Forest ranges for stock in transit the pressure has become so heavy as to make it absolutely necessary to cut down very materially the number of stock using them; for the driveways were fast becoming denuded of all vegetation and the sheep found little feed on them while crossing. In the final analysis it is believed shipping will be cheaper than trailing, taking into consideration all the losses and difficulties encountered in moving stock over driveways, some of them more than 150 miles in length.

Advances in the methods of range utilization and stock management on the Forests are being made along many lines. Continued success in the eradication of poisonous plants is reducing the losses of live stock from this cause. Many forward steps are made possible by the organization of range users in associations with which the Forest Service can cooperate for the introduction of improved methods with which all the users of a given range must comply.

Thus, on several ranges the permittees have agreed through their advisory boards, representing the local associations, to keep the yearling heifers separate from the other stock on a special range, so that they will not be bred until they are of suitable age. On a number of Forests the associations are maintaining special bull pastures in which the bulls are held until wanted on the ranges. On other ranges, where steers are numerous and interfere with calf production, separate ranges are set aside for steers only and all permittees grazing steers above 1 year old must hold them on this especial range. Usually this is done through a regular hired herder.

Open range branding, that long-standing source of loss and injury to the cattle and friction among the permittees, has been stopped on many Forests through the adoption of a special rule prohibiting the branding or rounding up of the cattle except at certain definite times or in the owners' own home corrals. Then all the interested stockmen are on hand, the range is worked systematically, and the calves are branded up, after which the stock is allowed to remain undisturbed for the rest of the season instead of being constantly milled and chased about by men who are more often looking for mavericks than for their own stock.

All of these things mean better returns to the permittees from their investments, decreased cost of handling, increased calf production, a reduction in losses of many kinds, and an improvement in the general forage conditions over the ranges, together with more harmonious relations among the permittees. Such methods can not be worked out on the open public domain, and this fact adds to the value of the grazing privileges on the National Forests.

Grazing permits issued and number of stock grazed under permit, fiscal year ended June 30, 1918.

State.	Cattle, horses, and swine.				Sheep and goats.		
	Permits issued.	Number of stock grazed.			Permits issued.	Number of stock grazed.	
		Cattle.	Horses.	Swine.		Sheep.	Goats.
Alabama	7	89					
Arizona	1,518	334,063	6,773	1,075	159	427,873	5,580
Arkansas	74	1,363	8	83	1	34	
California	3,142	214,312	8,410	1,076	464	570,722	11,233
Colorado	4,513	400,883	10,553		846	1,105,071	1,352
Florida	20	118		42	2	654	
Georgia	46	168	73	45	1	10	
Idaho	4,185	189,581	14,452		1,100	1,960,161	
Michigan	1	14			3	78	
Minnesota	1	53					
Montana	2,926	175,200	17,908		480	809,855	500
Nebraska	57	13,770	872				
Nevada	518	83,909	5,776		123	467,473	
New Hampshire	10	99					
New Mexico	2,238	186,640	6,291	640	653	483,501	39,007
North Carolina	174	898	51	84	8	89	
Oklahoma	73	4,322	255				
Oregon	2,492	156,583	10,380	10	551	783,473	181
South Dakota	743	31,639	3,754		1	1,500	
Tennessee	46	297	4		6	38	
Utah	7,397	178,851	10,681	316	1,607	842,327	115
Virginia	267	2,448	49		6	53	
Washington	948	29,306	1,761		174	222,272	
West Virginia	1	14					
Wyoming	1,203	133,234	4,105		328	779,056	
Total, 1918	32,600	2,137,854	102,156	3,371	6,513	8,454,240	57,968
Total, 1917	31,136	1,953,198	98,880	2,306	5,502	7,586,034	49,939

WATER POWER.

The receipts from water power permits were $93,976.35, as against $106,389.48 in 1917. Ten applications for preliminary rental permits were received, 31 for final rental permits (of which 28 were for permits for transmission lines only), and 14 for free permits, of which 1 was for a transmission line only. At the close of the year 16 preliminary rental permits, 228 final rental permits, and 107 free permits were in force for power projects involving the use of National Forest lands for reservoirs, conduits, or power houses, with or without transmission lines, while 142 final rental permits and 13 free permits were in force for transmission lines only, of an aggregate length on National Forest land of 838.8 miles.

The extent to which power development has actually taken place on the National Forests is best evidenced by the figures for the estimated average output at minimum discharge of the projects having reservoirs, conduits, or power houses on Forest lands. For all permits in force at the close of the year this was 776,709 horsepower, as against 738,450 at the close of the previous year. Of this, 405,368 horsepower, as against 365,208 one year previously, is credited to projects for which all construction is complete; 157,502 horsepower to incomplete projects; and the remainder to projects on which construction has not yet started.

The war has had a marked effect upon the electric-power industry. The demand for power is increasing rapidly. It is most acute in the

manufacturing centers of the Eastern and Central States and on the Pacific coast. The surplus capacity which existed on the Pacific coast prior to the war has been absorbed, and it has been necessary in many instances to meet additional demands by steam power. Conditions are rendered still more acute by a serious shortage in petroleum, the fuel upon which steam plants in this territory are very largely dependent. Under these conditions the extension of water-power development would seem natural.

The financing of new plants or of enlargements of established plants, however, is made difficult by the general financial and industrial situation. In so far as the use of National Forest lands or of the public domain is concerned, the uncertainty regarding legislation is a further and a severe handicap. With the enactment of a law putting an end to this element of uncertainty which has so long exerted a paralyzing influence in power matters, there may reasonably be expected enough new construction to provide for essential war needs. After the close of the war conditions unquestionably will be favorable to rapid and extensive development of National Forest hydro-electric power sites. The enactment of sound legislation that will remove the present uncertainties is greatly to be desired, from the standpoint of the interest of the public in having the water-power resources employed to best advantage.

GAME.

The National Forests, with the National Parks, represent the natural and permanent home of the remaining game in the States in which these public properties are located. With the advance of settlement and intensification of industrial development, wild life is rapidly forced back to the more remote forest regions. Until recently little attention was given to the problem of wild-life conservation. It was believed that in some way nature would provide for the perpetuation of the game. At the most it was thought that game laws governing the season of hunting and a limit on each hunter were sufficient. The wild life, however, rapidly diminished, and disappeared from many regions where it formerly abounded.

It is now clear that definite provision must be made for an intelligent and constructive administration of wild life based on the establishment of adequate breeding areas, winter feeding grounds, intelligently applied laws and regulations governing hunting, etc. In short, there is needed efficient game administration in contrast to mere protection. Laws alone, without such administration, will not automatically meet the situation.

Considerable progress has already been made in this direction on the National Forests. There are three National game preserves—the Grand Canyon game preserve, with its 6,000 to 8,000 deer and other game; the Wichita game preserve, with its buffalo herd of 100 head, its elk, antelope, deer, and smaller game; and the Pisgah game preserve in North Carolina, with an abundance of deer, wild turkey, and wild fowl. In addition, there are more than 40 State game preserves within the National Forests which constitute excellent breeding grounds for various kinds of game. There is much game elsewhere in the National Forests.

Special mention may be made of the 40,000 elk in the Yellowstone region, of which about one half are in the Forests surrounding the Park, and a portion of the remainder occupy at times National Forest land; of the 3,000 to 4,000 Roosevelt elk in the Olympic Forest; of the smaller elk herds in the Forests of central and western Montana and central Idaho; and of the new herds being built up in various Forests of Colorado, New Mexico, and Arizona. Mountain sheep and goats are found in the higher reaches of the National Forests in the Cascades, Sierras, and Rocky Mountains. Bear, black-tail and white-tail deer, moose, and fur-bearing animals are still abundant at many points.

Improved public sentiment, better game laws, and more active State game commissions, as well as the vigorous work of the Forest Service, have checked the diminution of wild life within the National Forests. At many points the tide has turned and increases are taking place. But the problem is by no means solved. If the National Forests were to remain a wilderness, mere protective measures would suffice. The Forests, however, will be increasingly utilized. Development of the resources will build up communities, and many more people will be occupied in the Forests in various activities. The right handling of certain classes of game is very dependent on the way the grazing of domestic stock is managed. This applies particularly to such game as elk, antelope, and black-tail deer, which are essentially grazing animals.

To provide for these conditions the Forest Service is developing specific plans of game administration for each Forest. Where game preserves are desirable the States will be asked to establish them. Winter ranges will be provided for herds of elk and other animals of appropriate size. Recommendations for legislation by the States and the Federal Government will be made to permit of the right administration of the wild-life resource, new plants of animals will be made where new herds should be built up, and the local officers will continue to aid in the enforcement of the game laws to the extent of their ability.

A new regulation has been promulgated prohibiting entering the National Forests with the intent to kill game in violation of State laws. It will bring cases of such violation into the Federal courts, and will thus supplement and strengthen the present procedure for game law enforcement.

ROADS, TRAILS, AND OTHER IMPROVEMENTS.

At the beginning of the fiscal year there was available for road and trail construction in the National Forests $2,399,179.11, derived as follows:

Agricultural appropriation for the construction and maintenance of permanent improvements	$400,000.00
10 per cent appropriation for the fiscal year	339,549.61
Unexpended balance of 10 per cent appropriation for preceding years	138,386.16
Appropriation for the fiscal year under section 8 of the Federal aid road act	1,000,000.00
Balance of section 8 appropriation for preceding years	971,243.34

At the end of the fiscal year there was an unexpended balance in the 10 per cent appropriation of $302,811.39, showing a total ex-

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penditure for the year of $175,124.38. There was also an unexpended balance in the section 8 appropriation of $1,803,837.37, showing an expenditure during the year of $167,405.97.

The following tabulation gives the number of miles of public roads constructed prior to December 31, 1917, from the 10 per cent, section 8, and cooperative funds:

Road construction and improvement,[1] from the 10 per cent, section 8, and cooperative funds, by States.

State.	Total mileage to Dec. 31, 1917.	Total mileage in calendar year 1917.		State.	Total mileage to Dec. 31, 1917.	Total mileage in calendar year 1917.	
		10 per cent fund.	Section 8 fund.			10 per cent fund.	Section 8 fund.
	Miles.	*Miles.*	*Miles.*		*Miles.*	*Miles.*	*Miles.*
Alaska	21.21	10.50	.....	Nebraska	4.60	.....	.....
Arizona	127.70	7.45	.....	Nevada	136.35	.....	4.00
Arkansas	24.50	5.25	.....	New Mexico	71.60	3.35	.....
California	257.88	22.50	1.40	Oklahoma	28.00	10.50	.....
Colorado	172.67	63.97	.....	Oregon	175.61	27.10	.10
Florida	10.00	.....	.....	South Dakota	14.05	.95	.....
Idaho	176.89	47.43	.....	Utah	143.35	.....	1.50
Kansas	3.40	.....	.....	Washington	82.63	2.07	.....
Michigan	22.20	.....	.....	Wyoming	76.10	1.95	.....
Minnesota	2.00	.....	.....				
Montana	192.25	11.50	.....	Total	1,742.99	[2] 214.52	7.00

[1] Does not include bridge or maintenance work.
[2] Road construction, 81.19 miles; repairs, 121.26 miles; trail construction, 12.07 miles.

While the total mileage constructed or repaired in the calendar year 1917 was about 74 miles greater than in the preceding year, it will be noted that very little work was done on section 8 projects, which are of a relatively high type of construction, and that only about 81 miles of road were constructed, in whole or in part, from the 10 per cent appropriation. It was stated in last year's report that little construction work could be anticipated. Difficulties in obtaining the necessary labor and materials were foreseen, but the allowances made for the effect of the war on road work were insufficient. The small amount of construction work done during the calendar year 1917 was due to some extent also to the delays involved in negotiating cooperative agreements, to the necessity for making location surveys and plans on section 8 projects, and to difficulties encountered in effecting a satisfactory organization.

In the spring of 1918 a considerable number of projects were ready for construction. While it was realized that the supply of available labor had been greatly reduced by enlistments and the draft and by the large enrollment in shipbuilding and other war industries, and while it was known that the cost of work would be very high, the full extent of the effect of the war on the road work was not revealed until attempts were made to let work by contract. Few contractors were willing to bid at all; and those making bids, in attempting to forecast the cost of doing work, submitted proposals greatly in excess of the engineer's estimates and the total amounts made available by the cooperators.

Supplementary agreements were found necessary in nearly all cases. In several instances the purpose of the supplementary agreement was to give the department control over the starting and stopping of construction work so as to avoid any possibility of interfering with the prosecution of the war. The remaining agreements were occasioned by the increased cost of the work. In some cases changes in the terms of the original agreements were made so as to lessen the amount of work to be done by reducing the standard of construction or the length of the project. In other cases, an increase was made either in the percentage of Federal cooperation or in the amounts which the cooperators agreed to expend. Naturally, considerable time was lost in negotiating these supplementary agreements and in endeavoring to let work by contract. In a large number of cases, therefore, the construction season was well advanced before contracts were let or the decision made that work must either be done by day labor or be indefinitely postponed.

The administrative action during the fiscal year on projects approved under section 8 of the Federal aid road act is indicated in the following tabulation:

Federal aid road act projects.

Type of work.	Number of projects.	Number of agreements.			Mileage.	Liability.		
		Original.	Supplementary.	Total.		Government.	Local authority.	Total.
Survey	8	8	.....	8	247.70	$23,622	$23,778	$47,400
Survey and construction	1	1	.....	1	45.00	270,000	40,000	310,000
Survey, construction, and maintenance	29	25	12	37	553.85	933,782	1,220,338	2,154,120
Maintenance	1	1	.....	1	45.00	.....	.....	.....
Totals (duplications eliminated)	38	34	12	46	846.55	1,227,404	1,284,116	2,511,520
Projects placed under original agreement during preceding fiscal year	4	.....	4	4	118.65	187,975	283,975	471,950
Totals for projects placed under agreement during fiscal year 1918 (duplications eliminated)	34	34	8	42	727.90	1,039,429	1,000,141	2,039,570

At the end of the fiscal year 43 projects were under cooperative agreement, involving the survey of 1,061.85 miles and the construction of 664.15 miles. The estimated cost of this work is $2,779,620, of which the Government's share is $1,347,554. In addition to the above, five projects involving the use of the 10 per cent fund were under formal cooperative agreement. These covered the survey of 43.84 miles and the construction of 54.56 miles at an estimated total cost of $152,550, of which the Federal share is $84,509. While a considerable percentage of cooperation is obtained in the 10 per cent work, the greater part of the projects are not covered by written agreements.

In selecting the projects for work during the calendar year 1918, great care was exercised to eliminate all which would tend to interfere with the prosecution of the war. The construction of several

projects which under ordinary conditions would have been of first importance was definitely shelved until after the war. As a result, the number of projects approved for work this year is comparatively small, and the anticipated expenditures considerably below the appropriations.

Comparatively few National Forest road projects can qualify for approval under the policy adopted by the United States Highways Council. A few projects, such as the Hornbrook-Seiad road in California, will prove to be of national economic importance through giving access to or promoting the output of necessary materials. Aside from projects of this class and certain others where the improvement of comparatively short sections is needed in order that work already done may be made available for the use of local communities, it seems probable that work on National Forest roads during the war will be confined largely to maintenance and repair, and to the construction and improvement of roads necessary to the protection of public property or to the relief of acute local needs. For this reason it is anticipated that a greater mileage of road will be maintained and a larger amount of money spent on maintenance and repair work than in any preceding year. This work will be paid for almost entirely from the 10 per cent appropriation. With the exception of investigative and survey work, the section 8 work will be largely at a standstill, and the money will be allowed to accumulate in the Treasury until the end of the war.

Amounts available for roads and trails from fiscal year 1919 funds.

State.	10 per cent item.	Section 8 Federal aid road act.	State.	10 per cent item.	Section 8 Federal aid road act.
Alaska	$9,656.78	$47,061	Alabama	$12.99	
Arizona	37,034.52	54,318	Georgia	172.50	
Arkansas	3,796.54	9,875	Maine	114.83	
California	43,441.35	141,558	New Hampshire	1,267.85	
Colorado	35,641.53	63,932	North Carolina	629.83	$25,665
Idaho	42,870.98	104,700	South Carolina	38.65	
Montana	30,639.02	71,664	Tennessee	489.78	
Nevada	8,670.22	19,228	Virginia	2,292.29	
New Mexico	27,428.86	37,811	West Virginia	294.21	
Oregon	38,074.87	132,796	Special fund		100,000
South Dakota	6,120.36	7,992			
Utah	22,922.70	39,370	Total	350,533.74	1,000,000
Washington	16,982.96	92,565			
Wyoming	16,238.25	41,510			
Florida	924.38				
Michigan	36.11				
Minnesota	3,214.08	9,955			
Nebraska	923.46				
Oklahoma	603.84				

In consequence of the strain put on the Forest force by its depletion through war demands and by the bad fire season, the usual reports covering various classes of work were not called for at the close of the fiscal year, which falls at the busiest period. It is therefore impossible to include in this report the usual details regarding the construction of improvements of various kinds. The general policy now governing all work of this character is to make no demands upon the country's supplies of labor and materials which can be avoided without detriment to the national effort for bringing the war to a successful issue and for reasonable readiness to meet post-war conditions.

COOPERATION WITH STATES.

Expenditures from the appropriation of $100,000 made by Congress for fire protection on the forested watersheds of navigable streams in cooperation with the States, and the expenditures of the States which have entered into cooperative agreements for this purpose, are shown in the following table:

Cooperative expenditures from Federal appropriation and by the States for protecting forested watersheds of navigable streams from fire.

State.	Expenditure fiscal year 1918.			State.	Expenditure fiscal year 1918.		
	Federal.	State.	Total.		Federal.	State.	Total.
Maine	$9,382.08	$98,305.27	$107,687.35	Wisconsin	$3,503.07	$16,094.32	$19,597.39
New Hampshire	6,899.85	26,563.97	33,463.82	Minnesota	9,090.96	47,341.80	56,432.76
Vermont	1,296.25	2,046.31	3,342.56	South Dakota	197.00	1,917.07	2,114.07
Massachusetts	3,417.34	31,187.79	34,605.13	Montana	3,385.23	13,493.34	16,878.57
Connecticut	950.75	7,380.86	8,331.61	Idaho	7,702.84	45,360.17	53,063.01
New York	5,299.29	97,885.86	103,185.15	Washington	9,770.00	38,929.46	48,699.46
New Jersey	2,105.85	23,841.75	25,947.60	Oregon	7,995.75	27,450.94	35,446.69
Maryland	1,631.50	3,769.68	5,401.18	Administration and inspection	8,081.19		8,081.19
Virginia	3,472.50	3,557.33	7,029.83				
West Virginia	5,455.50	7,129.16	12,584.66				
North Carolina	1,121.66	1,331.95	2,453.61	Total	99,952.14	573,761.98	673,714.12
Kentucky	1,669.36	7,067.27	8,736.63	Unexpended balance	47.86		
Louisiana	183.17	1,824.47	2,007.64				
Texas	3,783.00	5,184.96	8,970.96				
Michigan	3,555.00	66,098.25	69,653.25	Appropriation	100,000.00		

Louisiana requested cooperation, and an agreement was entered into toward the end of the fiscal year. This State makes the twenty-second to receive cooperation of this character.

The Federal fund was used almost exclusively for the hire of Federal patrolmen and lookout watchmen, who form an integral part of the State protective systems. The maximum regular allotment to any State for patrol purposes was fixed at $8,000, and additional smaller allotments were made from time to time to encourage the extension of patrol work, the construction of protective improvements, the preparation of forest-fire plans, and the like. It was necessary in a number of cases to make further allotments for increasing the salaries of the Federal men in order to hold the protective force intact. An adequate inspection of the cooperation in each State every year has shown that it is being well conducted, and has also afforded a means of keeping in close touch with the activities of the States in forest-fire protection.

On the basis of forest-fire statistics collected through State and private agencies in over 40 States, it is estimated that approximately 28,000 fires occurred throughout the country, which burned over an area of about 12,000,000 acres and caused a loss in timber, young-tree growth, and improvements of about $9,000,000.

The States of Arkansas, Georgia, Illinois, Louisiana, Mississippi, North Carolina, and Texas received assistance during the year in formulating forest policies, drafting forestry laws, and the like. Compilations of the forestry laws of Colorado, West Virginia, and New York were prepared.

WAR RESEARCH WORK.

Wood products are among the most important materials of the war. Lumber is required in immense quantities for the extension of

military posts, for the construction of buildings in connection with the new training camps, for ship building, for industrial housing, etc. The war has also brought an unusual demand for special wood products such as material for artillery carriages, escort wagons, and other vehicles, rifle stocks, airplanes, shipping containers, and various military materials and equipment requiring the use of by-products.

Critical problems have arisen relating to wood supplies, technical qualities of woods heretofore little used, drying processes, the development of waterproof glue, the design and construction of laminated structures and plywood, the manufacture of by-products of wood, and many other matters. The research work in forestry and forest products conducted by the Forest Service in past years has supplied a large part of the information needed by the military branches. The need for special war materials, however, has called for a great deal of information which in ordinary times would not have been needed for some years and which would have been gathered in the normal process of the research work. To secure this special information speedily, practically the entire research organization of the Forest Service has been placed on special war investigations and the organization has been increased in size more than five times to meet the situation. Information has been required by practically all the war-work branches of the Government having to do with the purchase of wood materials. These include in the Army the General Staff, the Bureau of Aircraft Production, the Ordnance Department, the Signal Corps, the Quartermaster Department, the Engineer Corps, the Gas Warfare Service, and the Surgeon General's Office; in the Navy the Bureaus of Construction and Repair, Steam Engineering, Yards and Docks, and the Navy Yards; the Shipping Board; the Emergency Fleet Corporation; the Director General of Railroads; the War Industries Board; the War Trade Board; housing organizations; the Fuel Administration; and the Food Administration. In addition, there has been cooperation and assistance to the allied Governments and to the industries furnishing war materials.

LABORATORY INVESTIGATIONS.

Among the most urgent problems requiring immediate extensive research were those connected with the construction of aircraft. One of the most exacting uses to which wood has ever been put is in the framework of airplanes and airplane propellers. In order to secure satisfactory material, the methods of selection, treatment, and use must be based on test data in the same way as is done with other structural materials like iron, steel, and cement. The Forest Products Laboratory had a large amount of data on the properties of airplane woods at the beginning of the war. Much more was needed, however, and since the war aircraft problems have occupied the attention of about two-thirds of the force at the Madison laboratory.

Information on the properties of various woods has been required by the Bureaus of Aircraft Production and of Construction and Repair in preparing specifications so as to avoid the use of material lacking in certain needed properties, such as shock-resisting ability, strength, stiffness, hardness, etc.

Spruce has been the standard wood for the wing beams in airplanes, upon which the strength of the wing depends, and for the

interplane struts between the wings. Sitka spruce from the west coast and red and white spruce from the east are all satisfactory airplane woods when properly selected and dried. Not only must checks and knots be avoided, but the direction of the grain must be carefully examined. Only a slight deviation from straight grain can be allowed.

At the beginning of the war it was customary to air-dry all wood used in airplane construction, on account of the danger of injuring the strength by methods employed in commercial kiln-drying. As it takes about two years to air-dry spruce in airplane sizes, and quantities of material were needed at once, kiln-drying was absolutely necessary. Investigations in kiln-drying had been under way at the Madison laboratory for several years, and methods had been worked out for a number of woods. An extension of these investigations to include spruce showed that it could be kiln-dried without loss of strength in less than a month. This information was used as a basis for preparing specifications for drying airplane stock. Numerous dry-kilns designed on the principles of experimental kilns at Madison, so as to allow the regulation of temperature, humidity, and amount of air passing over the wood to be dried, have been built by companies with airplane contracts. A large battery of kilns designed by the Forest Service has been erected by the Government at the cut-up plant of the Bureau of Aircraft Production at Vancouver, Wash.

The necessity for high-grade material in airplanes in order to keep down the size and weight of parts makes only a small proportion (from 10 to 20 per cent) of the lumber cut at the mill available. The high quality of material needed, together with the difficulties attendant on getting large spruce production and the increasing demands of the Allies, have necessitated the use of other species. The results of the extensive earlier investigations at Madison, supplemented by special tests, have made this possible. Port Orford cedar, Douglas fir, and other woods are now allowed for airplane construction, and a serious situation in the shortage of material is being relieved.

The test data which have been secured cover the relative suitability of many possible substitutes for spruce. These will make possible not only the selection of the best species to meet the maximum requirements which may be developed by the war but also (what is equally important) avoidance of the use of unsuitable species.

The work of past years has shown that practically no two woods should be kiln-dried under the same conditions of temperature, humidity, and circulation. It has been necessary, therefore, to develop safe methods of artificial kiln-drying for the best spruce substitutes.

A problem has also been encountered in finding how to select and treat wood for airplane propellers so that the finished propeller will give satisfactory results. Propellers are built up of several laminations glued together and then cut to shape. Much trouble has been due to the joints failing or the blades warping on account of unequal shrinkage or swelling in the adjacent laminations. Data covering density and moisture in laminations are being obtained with a view to reducing the percentage of failures.

Heretofore most propellers have been made of black walnut or mahogany. The heavy demand on these woods has made a search for substitutes necessary. Studies to find satisfactory substitutes are

being made. Tests also are being carried on to aid in the perfecting of designs for propellers. A waterproof coating has been found which practically eliminates absorption of moisture in the completed propeller, and hence shrinking and swelling, which are the cause of much propeller trouble.

Extensive experiments are being made in connection with the use of laminated construction in parts of airplanes. The production of material would be enormously facilitated if it were not necessary to rely on single pieces in constructing the wing beams of the planes, for these beams can be secured only from the most perfect wood. Various built-up beams and struts have been tested at the Madison laboratory, and a number of designs have been found satisfactory and used in airplanes. Methods are also being perfected for the most effective designs for various splices and joints, permitting the use of small-sized material, which can be produced in large quantities.

The use of laminated structures and veneers in airplanes requires waterproof glue, an expert treatment of the wood, and a very careful application of the glue in manufacturing the material. Waterproof glues have been developed and demonstrated to manufacturers, and the experiments have resulted in the drawing of specifications for the whole process of manufacturing laminated structures and veneers. Standard methods of tests have also been developed and a system of inspection and certification perfected to insure the acceptance of satisfactory glues only.

Plywood formed by gluing together several sheets of veneer will be increasingly used for various parts of airplanes. It can be formed or molded to the proper contour of the body or wing, and its possibilities as a substitute for linen, which has been generally used for body and wing covering, are striking. Little information has existed as to the properties of veneer and plywood as a structural material. Its greatest uses have been for industrial purposes, where an exact knowledge of its strength and stiffness was less necessary. A plywood wing rib, which supports the wing cover, has been developed for one type of plane as a result of the veneer investigations and has been adopted for standard production. The weight of this rib is nearly one-third less than that of the standard design, but its strength is 200 per cent greater. The significance of this may be realized when the importance of weight and strength in airplane design is considered. The results of these tests are indicative of what may be done for other similar airplane parts.

The military branches have encountered a problem of great magnitude in connection with containers and crates for over-seas shipments. There has been involved in the first place the question of suitable species of wood for containers and crates, and, second, of the designs which have the required strength and at the same time occupy a minimum shipping space. The necessary investigations have been conducted in cooperation with the Division of Purchase and Supplies of the General Staff and the Ordnance Department. The result has been the improvement of specifications for containers and crates, and the use of many more species with a consequent very large saving of cost to the Government and of shipping space, and with a great reduction in loss by breakage. The results of former work on shipping containers, conducted in cooperation with the Bureau of Explosives and the Association of Box Manufacturers, have been of di-

rect application in aiding the present war program. New problems are constantly presenting themselves.

The question of rapidly drying gunstocks has been a matter of prime importance. The work already done along this line in cooperation with large arms companies was of great help in furnishing companies with gunstock contracts with necessary data to cut their losses to a minimum. The possibility of using laminated gunstocks in place of the standard one-piece stock has been under investigation. Such gunstocks would make usable much smaller pieces and a considerably larger portion of the black walnut cut.

Under ordinary commercial practice oak and other vehicle stock has been air-dried, requiring a period of from two to three years. The greatly increasing demands of the war for dry material have rapidly depleted surplus stocks of dry material, which are now approaching the point of exhaustion. Tests have shown that oak under proper methods can be dried with a much smaller percentage of loss in kilns than in the open air, and the period of drying reduced from two or three years to two or three months. The investigations have been placed at the disposal of a great number of manufacturers of war orders. The assistance given these manufacturers has included the design of a large number of kilns, with a consequent vastly enlarged kiln capacity, and the improvement of drying methods.

On account of the shortage of tin the use of fiber containers made from wood pulp has been considered for many new purposes. Investigations made in cooperation with the Ordnance Department and the Food Administration have yielded results of definite practical usefulness in the packing of ammunition.

The Forest Service has been called upon also for investigations in connection with wood-distillation products for various military uses.

The laboratory is cooperating in the training of men to act as box experts in the various offices of the War Department, as box inspectors at ports of embarkation and manufacturing plants, and as box makers. A considerable number of kiln operators and inspectors, glue experts and inspectors, and in general experts and inspectors on wood for practically all of its numerous uses in modern warfare are being trained for the Army and for private manufacturers.

A large part of the work done along all lines has already had direct application in specifications for raw and final wood products, in design, in technical processes of manufacture, and, in fact, in almost every phase of selection, purchase, and utilization. The services of members of the Forest Service are in constant demand for advice and assistance of this character in both the Army and the Navy.

FOREST INVESTIGATIONS.

From early in the war urgent demands have been made upon the Forest Service for information regarding various kinds of timber which were not being produced in sufficient quantities, such as spruce, black walnut, bark and acid wood for tanning, and wood fuel. Information was also needed on species which were in danger of running short of grades particularly necessary for specific war purposes. Among the woods of this group are chiefly the eastern hardwoods—the oaks, the ashes, hickory, basswood, beech, birch, rock elm, and maple.

As substitutes for Sitka spruce the eastern red and white spruces were first investigated. A very comprehensive study was made of the available supply of eastern red spruce, which facilitated its use by the Navy for airplane construction. In addition, the supplies and grades of Port Orford cedar, western white pine, Douglas fir, incense cedar, redwood, cypress, western hemlock, the true firs (silver, noble, white and lowland), and sugar pine have been investigated. The eastern white and Norway pines and yellow poplar, which next to spruce are the most promising eastern species, were covered in considerable detail by field studies. Purchases are already being made of a number of these substitutes by the Allies and the United States.

Black walnut is of prime importance for the construction of propellers and for gunstocks. That its value was appreciated by the German Government is attested by the fact that large quantities of it were exported to that country in the years immediately preceding the war. The production of black walnut has been considerably increased since the United States entered the war and is now probably taking place at the rate of about one-fifth of the country's total stand per year. The Forest Service has been assisting the War Department in its campaign to stimulate the production of walnut for war uses. Several men have been maintained in the field since early spring looking up supplies of timber. The States Relations Service has given very valuable cooperation in the search for walnut timber. Detailed studies were made of the methods of manufacture, with a resulting increased efficiency.

The Forest Service also cooperated with the Boy Scouts in conducting an organized search for black walnut.

There might seem to be little connection between the Army's requirements for shoes and the forests, but in point of fact the immense quantity of heavy leathers required for the large order of the new Pershing shoes brought the country face to face with a serious shortage of tanning materials. Under normal business conditions the tanning industry of the United States uses about 175,000 tons annually of imported tanning materials. Owing to the scarcity of ships it was impossible for the Shipping Board to provide space for such a large amount of material. The Forest Service therefore undertook a study of the domestic tanning industry at the combined request of the Shipping Board and War Industries Board. A thorough canvass was made of the chestnut extract plants in the Southern Appalachians and of the bark producers in the North. It was found that the supply of wood on hand at the plants was only about 40 per cent of the normal supply, and that the plants were producing only about 70 per cent of their possible output. The reasons for this situation were found to be lack of woods labor and of transportation facilities, shortage of coal, shortage of labor at the plants, and delayed transportation of the finished products and the return of tank cars. Owing to the labor situation the price of acid wood in many localities has advanced from $5.50 to $10 per cord of 160 cubic feet. The amount of chestnut oak bark and other barks on hand was also found somewhat below normal. As a result of the investigation the War Industries Board, in cooperation with the Labor Department, the Railroad Administration, and the Fuel Administration, took remedial measures so that the extract plants could run at increased capacity.

In early times wood was almost the exclusive fuel in use, but it was long ago displaced by coal for almost all industrial purposes and for domestic use in most cities and towns. Of recent years the same thing has been taking place in many of the more prosperous farming sections, even with plentiful local supplies of wood at hand. The fuel emergency which came last winter changed this. From a matter of individual convenience, the choice and use of fuel became a national question of vital importance directly bearing on the war. It was soon found the coal was not sufficient to go around and that transportation was short even if there were enough coal. Measures were at once adopted to save coal and increase its production, but this was not enough; the lack of transportation was still to be met. It was then that the long-neglected wood fuel was thought of, as it was already distributed and formed a good reserve.

A wood-fuel campaign was opened by the Forest Service in the summer of 1917 and was carried on during the winter of 1917–18 in cooperation with the Federal Fuel Administration and various State and national agencies. Organizations were effected having in view the production and distribution of wood fuel to save coal and transportation. In the depth of winter, as the crisis became acute, great interest was aroused and action was taken by many communities.

The vital objective of the wood-fuel movement is to increase the use of wood fuel where it is possible—i. e., on the farms, in country villages, and in certain industries located convenient to wood supplies; also further to encourage the use of waste material from lumbering, from manufacture, and from dead trees and culls. The protection of permanent forest resources is not to be lost sight of in the emergency, nor are parks to be invaded and shade trees destroyed. The methods followed aim at bringing the producer and consumer together, building up reserves, and insuring a reasonable and just price. The effort for the future should be directed toward permanent fuel organizations, a systematic survey of fuel resources, adequate reserve stock, and local price regulation.

The hardwoods are playing an increasingly important part in our war program. Thus, both white and red oak are needed for airplane propellers and ship timbers. White ash, elm, hickory, hard and soft maple, yellow poplar, basswood, beech, and yellow and black birch are being sought for parts of airplane construction, veneer panels for aircraft, ammunition boxes, bent work, gunstocks, wheels, escort wagons, and many other essential war needs. Black locust is essential for treenails in shipbuilding. These hardwoods are being studied to determine the amounts of material that can be supplied by the mills, in sizes and grades needed for Government specifications, to ascertain the amounts, location, and availability of standing timber suitable for continuing the production of these grades and sizes, and to increase production by improved technical methods. Since the same species, and often the same grades, are being used for different purposes, as white oak for propellers, for shipbuilding, and for escort wagons, the study aims to adjust these different demands upon the same species and grades and attempts to eliminate the use of certain grades for needs for which some other species can be used. The points which are being sought in connection with this study of the hardwoods are quality, with reference both to present and probable future specifications of the Navy and Bureau of Aircraft Production;

accessibility; approximate total quantity and percentage of material particularly suited for propeller stock, wing beams, or any other special use; present utilization; improvements in logging or milling which will increase production; and means of utilizing new tracts.

In general a large amount of information on the most suitable woods for various purposes, together with their sources of supply, availability, and commercial value, have been furnished to the War and Navy Departments and to other cooperators.

The Forest Service has also undertaken a comprehensive study of the current production and distribution of lumber and a census of the wood requirements needed to carry out the military program. Its purpose is not only to analyze the factors which have a direct bearing on lumber production and distribution, but also to formulate a constructive policy which will aid the industry in meeting the demands made upon it. The results will be available in the form of current statistics on lumber production, shipments, and stocks on hand, supplemented by special reports on various industrial problems common to the lumber industry. Data regarding the annual production of lumber, lath, and shingles, the production of wood pulp and consumption of pulpwood, the amount of timber treated with wood preservatives, and the quantity of preservatives used were collected as in past years; and arrangements were made for collecting and compiling data on wood distillation, cooperage manufacture, and plywood manufacture. A large volume of statistical data of this character has been furnished for the use of various Government units. Figures on production and consumption in many instances have been used as a basis for reaching conclusions in problems of utilization, substitution, and regulation of imports and exports.

The requirements of the war necessitate a still further enlargement in the research organization, for which funds are urgently needed.

MISCELLANEOUS.

Thirty-four new publications were issued. The distribution of Forest Service publications totaled 370,100 copies. About 110 addresses were made, mainly at expositions and upon request from National Forest users, lumbermen's associations and similar trade bodies, technical societies, and educational institutions. Lantern slides were loaned to more than 256 persons engaged in educational work. These were shown 489 times and to 28,000 persons. Additions to the lantern slide collection totaled 1,749, and 61 bromide enlargements and 1,731 lantern slides were colored. Traveling exhibits of photographs, maps, drawings, and wood samples were loaned to 126 schools and libraries.

Additions to the Service Library in Washington totaled 804 books and pamphlets. The index of forest literature was extended by entries covering 2,652 books, periodical articles, and manuscripts. Arrangements were made for abstracting the principal articles in the forest and botanical journals, and a number of new bibliographies on special subjects were prepared, of which one on forest taxation and one relating to paper were published. Loans from the library totaled 3,220 books and 4,987 periodicals. The 166 branch field libraries now contain 31,468 books recorded in the main library, besides various State and other publications not so recorded.

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