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HISTORY OF TIMBER MANAGEMENT IN THE
CALIFORNIA NATIONAL FORESTS

1850 to 1937

By

R. W. AYRES, Conservation Writer
and Forester (Retired)

A comprehensive - and at times humorous - history of the development of timber management and the lumber industry in California. R. W. "Bummer" Ayres has treated the subject thoroughly and with the honesty which could come only from one who grew up with the timber business in the West and the problems incident in trying to carry out the policies and plans formulated by Washington for the "farthest out" of the newly established Forest Reserves.

FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

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HISTORY OF TIMBER MANAGEMENT IN THE CALIFORNIA NATIONAL FORESTS

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R. W. Ayres, Conservation Writer
July, 1958

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OUTLINE OF THE HISTORY OF LUMBERING IN CALIFORNIA

TO 1850

In the days of the Dons the lumber industry in California was not important. Adobe for walls and tiles for roofs and floors - or just puncheon floors were the style of the early California architecture. Wood consisted mainly of peeled poles for rafters and hewed sills and beams, and if the aristocracy had hardwood floors in their houses it probably came from Spain or Australia. It is a fact that the first settlements in the State were, with the exception of Monterey, rather far removed from the timbered zones. The early ranchers found timber scarce in the valleys as is evidenced by the ruins of the old stone houses seen occasionally in the foothill regions of the Sacramento and San Joaquin Valleys.

The Russians built a sawmill at Fort Ross in 1818, the first on record for the State. In those days Monterey was the capital and the settlement and civilization of that section was far in advance of the rest of the State. Whipsaw pits are found in Santa Cruz County which date before 1840. According to Fairfield's History of Lassen County (page 168), Peter Lassen bought some land and built the first regular sawmill to operate in Santa Cruz County in 1841. After cutting about forty thousand feet of lumber he sold out to Captain Isaac Graham for "One hundred mules," and went to make his reputation as a guide and colonizer.

This Captain Graham is credited with putting up the first steam saw mill in the state at Layonte in Santa Cruz County in 1842. If this is true, it antedated Captain Stephen Smith's steam lumber and flour mill at Bodega Bay in Sonoma County by two years. The next oldest mill was built by James Peace in what is now San Mateo County. Schooners carried sawed Santa Cruz redwood lumber to the Sandwich Islands as early as 1847 and when the gold rush commenced, they were shipping it to San Francisco at \$200 per M board feet.

The San Francisco Bay region had been developing a little redwood lumber industry of its own. James Dawson whipsawed lumber in Sonoma County for the village of Yerba Buena in 1838 and brought it down by boat. Elam Brown whipsawed a small amount of redwood from the hills back of Oakland. There were other little concerns at Corte Madera, Mill Valley, where there was a mill, and at Bolinas Bay in Marin County. These sold their lumber in the Bay region or sent it up the Sacramento River where Sutter was founding an empire. It was Sutter's own sawmill at Coloma on the South Fork of the American River that changed the course of California history suddenly and dramatically. The few grains of gold which James Marshall picked up in the tail race of Sutter's new saw mill in January, 1848, drew a tide of emigrants from the whole world through the Golden Gate who accomplished a colonization within a few years which ordinarily might have taken several decades.

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MINING AND THE LUMBER GAME.

The immediate effect of the Gold Rush was the establishment of the Northern California redwood lumber industry. The Santa Cruz redwoods required difficult wagon roads and a comparatively long haul to get lumber to the coast. Leisurely methods were part of a past era,- there was no time and no labor to spare in those hectic days; Monterey was forgotten and the Santa Cruz lumber industry languished for the next twenty years.

San Francisco became the chief center of the State and the lumber industry moved to Sonoma and Mendocino Counties. Sonoma was nearer to the City but it had a shorter coast line, fewer landing places for ships, and less accessible timber. Mendocino was ideal for the early day loggers. It's 100 miles of coast has about 40 inlets at the mouths of streams where small craft could land in good weather. Good timber grew on the flats and adjacent hills ready for the pioneer loggers and by 1852 there were 70 mills sending their lumber to San Francisco and the towns of the interior valleys.

Among the earliest of these mills was one built in 1851 about three miles from Albion in Mendocino County, an account of which was given in the Timberman for March 1940. It utilized the outgoing and incoming tides as a power plant and had a muley perpendicular saw. The Weatherly Company built the plant and ten miles of railroad at Albion. The Mendocino development was accomplished by small pioneer outfits. A dozen or so men with horses or oxen, pulley blocks, jackscrews, and hemp rope were the essentials for logging. They cut high stumps, long-butted or left standing the largest trees which they could not handle and drove logs down Big River, a practice which is still carried on today. Pictures of those times show men who looked more like miners than loggers, and perhaps they were miners who were collecting a stake before starting for the "gold in them thar hills."

Logging in the redwoods of Humboldt County began about the same time as in Mendocino, but more slowly and with a different type of development. Humboldt Bay was reopened and large mills began to be built around the shore and on the islands in the Bay. By 1860 such mills as Dolbeer and Carson, Smiley, Excelsior, Mad River, Trinidad, Dolly Varden, Eureka, Millford and Falk had survived the depression of 1854 and were supplying most of the 10 million feet of redwood lumber used in San Francisco that year, and were shipping lumber to Australia, China and South America. The Humboldt Country had more and larger timber than was found anywhere else and many of the developments in logging methods originated there. While all of this was happening in the coast redwood region, lumbering in the mining sections in the pine region of the Sierra Nevada was going through its pioneer stage.

THE EARLY PINE LUMBERING

In the 1850's all the communities and towns in the placer mining country had their small sawmills. They cut first into the lower edge of the ponderosa pine type and later worked higher into the sugar pine and white fir types. Some of the mills were steam and many used water power. Some of the saws were straight, resembling the blades used on the power saws of today. The up and down cut was probably inherited from the old whip saw method. Such a mill stood until 1909 at the upper end of the Tuolumne Ranger Station on the Stanislaus National Forest. It was built in the early days to cut out lumber for a flume used to carry water first for mining and then for irrigation. There was a mill in the 1850's at Shaws Flat near Sonora, now 20 miles west of any logging operation, and the same conditions prevailed all through the Mother Lode country. E. R. Stanford (History of Lumbering in California) gives the census of 1852 as recording mills in Butte, Yuba, Nevada, Sierra, Plumas, Trinity and Siskiyou Counties. Nevada had a mill powered with an engine taken from a steam boat and boasted of \$129,000 invested in saw mills. Just how many of these small pioneer pine mills existed and where they were located is a fit subject for the special study now being carried on by the California Forest and Range Experiment Station. A report by the Geological Survey made in 1900 states that in 1898 there were nine large, and five small mills in what is now the southern half of the Eldorado and the northern half of the Stanislaus Forests. An equal number were found abandoned. Logs were hauled to the mills in 2 or 4 wheel trucks. After the haul got out from 2½ to 3 miles the mills were abandoned and located further up. The report said that the mills then operating had been at work from fifteen to twenty years. According to E. R. Stanford, most of the pine mills from 1850 to 1860 were located between Plumas and Tuolumne Counties.

The placer mines had been worked out by 1860 and it was to be a few years until the veins of the Mother Lode were to open the quartz mining chapter of California. By the time they were in full swing the trans-continental railroad had come to the Coast and a new development in settlements and industry began. Lumbering in the pine region was directly affected by the railroads. But before going ahead with the story, it would be best to go back and tell what was happening in the lumber industry in a part of the State of comparatively small importance at the time- southern California.

SOUTHERN CALIFORNIA

Today the only tract of commercial timber below the Tehachapi Pass is located in the San Bernardino National Forest. The same seems to have been true in 1854 when the Mormon colonists came to that region. The Mormons might have been willing to build with adobe and tile like the Spaniards, but they were great irrigationists and they had to have flumes for agriculture just as the placer

miners of the Sierra Nevada built ditches and flumes for hydraulic mining. In those pre-Iowa days, the Pueblo de los Angeles apparently did not require lumber or anything else. It was to be over twenty years before the Santa Fe Railroad was to bring in the boosters who discovered something about the climate at the Pueblo which seemed different from the atmosphere elsewhere in a hundred mile strip. If it was not different before they came, it certainly was afterwards and has been so ever since.

From a report by R. D. Craig, made in 1904, one of the first mills was at Seeley Flat built, presumably, by Seeley in 1854. A logging road led up Waterman Canyon which was so steep that loaded lumber wagons had to use good sized saplings as a drag when going down. Other mill locations were in Houston and Little Bear Valleys and in all there had been eleven mills on the Little Bear drainage; four mills at Grass Valley and Houston Flat; two each at Seeley Flat and Sawpit Canyon and the largest was the Brookings Company at Fredalba which began in 1886. Some of the early operations were water power, especially in Little Bear Valley, where the original log dam had rotted down by 1876. When Craig was there in 1904, the land from Devils Canyon to Little Bear was being cut over for the third time.

This lumber supplied the local towns of that region from Los Angeles to San Bernardino and was sufficient until the boom times of the 1880's. The supply of timber in this area was limited and it lost its importance as a lumber producer soon after the turn of the century.

LAKE TAHOE - A LUMBER CENTER.

According to Mark Twain's account in "Roughing It", he visited Lake Tahoe early in the 1860's. From his description of his trip he and his companion found the lake shores an uninhabited wilderness. Yet George Wharton James, in his book "The Lake of the Sky-Lake Tahoe", says that Captain A. W. Pray built a sawmill at Glenbrook in 1861. However, this mill was run by water at first, and James states that this was uncertain power and later was replaced by steam. Perhaps the mill was a small one and was shut down when Mark Twain was there. This was the commencement of an important lumber producing center which lasted for over twenty five years.

Following Captain Pray, several other small mills were built at Glenbrook by Goff and Merrill, A. H. Davis and Wells Fargo Company. They hauled lumber to Carson City and to Virginia City where the Comstock lode was making Knob Hill millionaires out of a group of San Francisco men. In 1873 Yerington and Bliss revolutionized the Tahoe lumber industry. They built a flume from Summit down Clear Creek to the Virginia and Truckee Railroad south of Carson City. To supply this flume with water they dammed up several small streams and led this water to the head of the flume. They connected the mill at Glenbrook to the flume with a narrow gauge railroad six miles long.

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By 1875 Douglas County, where Glenbrook is located, was producing over 21½ million feet of lumber a year. In 1881 there were four saw mills running day and night, making it the greatest lumber town in the Southwest.

Incline was built in 1882 to supply the Virginia mines with lumber and fuel. A 1600 foot tram took loaded lumber cars to a flume on the summit which carried the lumber to Lake View on the Virginia and Truckee Railroad. Incline was quite a town at one time; now it is nothing more than a name and the mills at Glenbrook have been replaced by a hotel. Also in Nevada a flume which supplied their mines was built by Flood and O'Brien where at one time a million feet of lumber in mining timbers and 3,000 cords of fuel a month were consumed.

So great was the cutting around the Lake that a protest was raised which resulted in the appointment of a commission in February, 1883, to see what could be done to preserve to the public the remaining timber. It was recommended that the State acquire the patented land around the shores by giving lieu land to the Central Pacific Railroad and to the other private owners for their holdings. Nothing was accomplished and the large holdings have never been broken up. Today the Forest Service has just one quarter of a mile out of a 72 mile shore line - the gift of the late William Kent - and a few scattered 40 acre tracts adjoining the lake.

One company dammed up the outlet of Lake Tahoe, the Truckee River, for power, and another put a dam across the river below Tahoe City and drove logs down to a sawmill at Truckee. There was a mill at Verdi and from Boca a narrow gauge tapped a timber country between there and Loyalton. Considerable logging went on in that vicinity, especially towards the end of the century. Such mills as the Horton Brothers, Lewis Brothers, March Lumber Company and Roberts Lumber Company were gradually absorbed into what is now the Clover Valley Lumber Company. The Hobart Estate Company took over the Sierra Nevada Wood and Lumber Company in 1897 and logged until 1936.

MONO MILLS AND BODIE.

Another east side lumbering operation which was also the result of mining and in the same general locality and time as the Tahoe development was the Mono Lake Lumber Company. Originally, in 1875, this company held about 23,000 acres of Jeffrey pine in Mono County to supply the mines at Aurora and Bodie with mining timbers, building material and fuel. At first the logs were hauled to Mono Lake by bull team, rafted across and then hauled over the mountains to the mines. A mill was built at Mono Mills in 1880, located south of the Lake and east of the craters and this was connected to Bodie by a narrow gauge railroad. The operation depended on the fluctuations of the mining game. It has been dead for so many years that even its ghost is almost forgotten.

The Tahoe logging operations started out as an adjunct of the mining industry but with the building of the Central and Union Pacific it became involved in larger affairs. From 1863 to 1869 the building of this transcontinental road stimulated the lumber business of this region. Its completion brought a new chapter to the industry in California.

THE RAILROADS AND THE SIERRA PINE REGION.

The completion of the transcontinental railroad in 1869 was just the beginning of railroad development in California. The Valley route was pushed south to Fresno by 1872 and reached Los Angeles four years later. The Central Pacific to Oregon reached Chico in 1870, Redding in 1872, but because of many troubles it was not connected with Portland until 1887. The Coast line and the Santa Fe have had little effect on the lumber business of the State. The pine lumbering as distinguished from the redwood now began to gain importance.

In 1876 Hough gives the cut of all 335 California mills as 492 million feet. In 1879 it was 260 million feet from 328 mills and probably 80 per cent of this was redwood logged from Mendocino to Del Norte. Hobbs Wall and Company had been active in Crescent City since the early 1850's. Around Humboldt Bay the Union, Hammond, Holmes and Lane, and Dolbeer-Carson were sending millions of feet of lumber by boat to California markets. Logging railroads were introduced in the redwoods and Dolbeer-Carson are credited with the first steam donkey engine in the logging woods in 1881. The Santa Cruz redwood industry began to revive in 1877 when the Santa Cruz & Felton Railroad was finished and Grover Mill was built on Soquel Creek to be followed in later years by mills at Boulder Creek and Bonny Doone. The manufacture of redwood shingles and railroad ties was a good business in Santa Cruz County until about the turn of the century.

The situation in the pine region west of the Sierra Nevada, at the beginning of railroad development, was only a slight enlargement of pioneer conditions. The mills were mostly steam but their markets were confined to local towns and communities. The young cities of the Sacramento and San Joaquin Valleys from Redding to Bakersfield drew on the adjacent Sierra pine timber belt and each one of these communities has its individual lumbering history too detailed to be included here. The cost of transporting the lumber from the mountains to the consumer was expensive and before the railroads came there were no large operations designed for export trade. Those were to come in the 1880's and 90's.

FLUME COMPANIES.

According to Hittell in "Commerce and Industry of the Pacific Coast" the "V" flume was invented by James N. Haines of Genoa, Nevada, in 1868. At least Haines claimed to be the inventor. Haines first

tried the box type, used by the miners to carry water from the back country to the placer and hydraulic grounds, but this was not successful and he tried a "V" flume which gave the most floatability for the least construction and the smallest amount of water. He obtained a patent for it which later led to law suits with the firm of Bliss and Yerrington in 1892. This idea was copied extensively up and down the Sierra pine region for about 25 years afterwards.

Flumes made use of native materials and cost from \$1,000 to \$20,000 a mile, but maintenance costs were high, and they required constant watching to prevent hang-ups of the bundles of boards or timbers. No doubt this was one of the chief causes of the many changes in ownership which took place in the first large scale logging in the pine region. None of the lumber companies operating in 1900 had the same names or were under the same ownership as when originally organized. Some changed their names three or four times.

One of the first, if not the first, of the big flume outfits, started out in 1874 as the California Lumber Company, became the Madera Flume and Trading Company, and ended as the Madera Sugar Pine Company. A 60 mile flume delivered lumber from the large mill pond at Sugar Pine, south of Wawona in the Sierra Forest to Madera.

A little to the southeast of the Madera plant is Clovis, the terminus of a 50 mile flume once the property of the Fresno Flume and Lumber Company. Originally it was the Fresno Flume and Irrigation Company, when it was acquiring land in the late 80's. The entire property was bought by the Southern California Edison Power Company, in 1919. Shaver Lake, the original mill pond and the intake of the flume, was enlarged in 1926 for hydroelectric power development. Both this company and the Madera Sugar Pine used railroads to bring logs from the woods to the mills. Both cut about 35 to 45 million board feet a year which they manufactured in planing mills, box factories and sash and door factories at Clovis and Madera.

One of the most noted of the old operations was the Hume-Bennett Company, organized in 1887 as the Kings River Lumber Company. Logging started in 1889 in once magnificent Converse Basin, with bull teams to an upper and lower mill at Millwood.* Lumber was sent down a 60 mile, million dollar flume to Sanger where there was the usual planing mill, yards, and manufacturing plants. The depression of 1893 broke this company and part of the personnel went north to Scotia. It was reorganized in 1897 as the Sanger Lumber Company and operated until about 1907 when it became the Hume-Bennett Lumber Company. In 1904 it had 20,000 acres out of an original 36,000 acres; 5,000 acres of cut over and burned over land had been traded in for scrip - a little joker of an old land law which

* See Brewer, "Up and Down California", pg. 514.16.

enabled logging outfits to perpetuate their timber land supply with only an original investment. By 1908 it was reported that 10,000 acres which formerly grew pines, firs and giant sequoias, were in chaparral, snowbrush and mountain misery.

It was in this vicinity, particularly in Converse Basin where the cutting of the giant sequoias commenced, a profitless and wasteful record of vandalistic devastation which ultimately led to the creation of national forests and national parks. This big tree logging will be taken up in the section on Land Acquisition and Forest Conservation.

These three were the largest of the old flume companies in the northern Sierra region. The West Side Lumber Company was organized in the late 1890's as the West Side Flume and Lumber Company, but no flume was built. By that time it was more economical to invest in a railroad than to build a flume.

The largest of all fluming companies was the Sierra Flume and Lumber Company organized in 1875. It owned 60,000 acres in Plumas, Butte and Tehama Counties; built 10 mills and 150 miles of flume to take lumber to Chico and Red Bluff. River steamers transported timber from Red Bluff to the sea. The company failed and the Sierra Lumber Company took over its sawmill and 100 miles of flume. That outfit was taken over by the Diamond Match Company in 1907 which soon substituted a new mill at Stirling City and a railroad for the old flumes.

The last flume company on the list, and the one farthest north in California, was the Shasta Land and Timber Company with headquarters in Bellevista. Its flume ran from the sawmill on Montgomery Creek 20 miles to Bellevista. A narrow gauge railroad carried the lumber from there to Anderson below Redding on the Central Pacific. The Shasta Company took over the Terry Lumber Company.

OTHER EARLY PINE COMPANIES.

One more mill completes the list of the large early day pine operations which manufactured lumber for shipment to outside markets. This is the McCloud Lumber Company. There is a tradition that a Central Pacific conductor who had become wealthy because of the absence of railroad ticket offices started a sawmill at Upton, near Mt. Shasta City, or Sisson in those days. Scott and Van Arsdale took it over and intended to locate in Sisson, but believing that the town authorities were trying to hold them up, moved the outfit to the present site of McCloud in 1888. The McCloud Lumber Company, an eastern concern, bought out Scott and Van Arsdale in 1903.

Another eastern outfit which left a tradition behind was the Benton Company. Benton was said to have been related to General John C. Fremont, famous as one of the explorers of California. He acquired some fine sugar and ponderosa pine timberlands on the hills above the

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Big Bend of Pit River and proceeded to operate like they did back in the Lake States, by driving the logs down Pit River to the saw-mill near Anderson. Like other eastern loggers, who later came west and made mistakes, Benton did not investigate conditions here and find they are not as they were back home. The Pit River was full of boulders on which to hang up a log drive and, most important, the western pines are much heavier and less bouyant than the eastern pines. The butt logs and some of the lower cuts of the big sugar pines sank to the bottom or hung up on rocks. A lot of the most valuable never reached the mill and it was forced to depend mostly on ponderosa pine.

Weed was started in 1897 by Adner Weed. R. A. Long of the Long Bell Lumber Company bought the plant in 1932.

LAND ACQUISITION AND FOREST CONSERVATION.

The lumber business expanded during the decade of 1880 and new timber properties were acquired by eastern lumbermen who foresaw the end of the timber supply in the Lake States. But the timber locators did not really get down to business until after the passage of the Forest Reserve Act of March 3, 1891.

The chain of events which led to the passage of the reserve law, which was really only a rider to an appropriation bill, had really begun some forty years previously. It was the outgrowth of conservation sentiment originating in all parts of the country. But some of the causes of this movement were directly the result of what was happening in California. As early as 1852 the country was astonished and interested by the discovery of the giant sequoias in California. John Bidwell is said to have discovered the Calaveras Grove in 1841, but it was A. T. Dowd, a hunter, who gave the news to the world. By 1854 they were shipping sections of this species to the Crystal Palace in London, England. The creation of the Yosemite Park in 1865 included the Mariposa Grove and protected that group, but all the other groves were left open to homestead, pre-emption and script filings.

John Muir, in his book "Our Natural Parks", describes logging the big trees in 1875 and evidently by that time it was a going business, for he deploras the waste of material and the folly of destroying those wonders of nature. In his report of June 30, 1879, Secretary of Interior Carl Schurz, says, "The waste and destruction of the redwood and the big trees of California have been and continue to be so great as to cause apprehension that these species of trees, the noblest and oldest in the world, will entirely disappear unless some measures by soon taken to preserve at least a portion of them." He proposed that the President withdraw from sale and disposition an area of two townships of redwoods in the northern part of the State and two of big trees in the southern part. In the same report he criticizes the Timber and Stone Act of June 3, 1878 as a law which would "stimulate a wasteful consumption beyond actual needs and lead to wanton destruction." He

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recommended that the Government be authorized to sell timber from public lands without conveying title and to conduct such sales so that the timberlands would not be devastated but left in a producing condition. If Congress and the country had heeded the voice of this real conservationist the course of American forestry, and all the industries which depend upon timber, soil and water would have been different. In commenting on these conditions, F. B. Hough, the first Forestry Commissioner said, in his report of 1879, ". . . It is clearly evident that the absence of any provisions tending to the protection of future growths or to the prevention of waste will, in future time, be regarded with unavailing regret." Certainly a prophetic statement.

Secretary Schurz's recommendations brought no results. Nothing was done either to save the sequoias or to inaugurate a forestry policy. At that particular period of the country's development any recommendation for the conservative use of the natural resources of timber or land would have had the opposition of two powerful groups of rugged individualists, then called "empire builders"; now they would be among those termed "economic royalists." Those were the railroad men and the lumbermen. One can imagine Schurz's regret at not being able to save, by the forestry science of his native Germany, the magnificent heritage of timberlands which he saw in Western America.

Far from saving any of the big trees, things went from bad to worse. They quickly passed into private ownership and the lumbering, or rather the destruction of them, went on more rapidly as steam logging replaced animal power. The credit for rescuing what were left of the big trees in the General Grant and Sequoia National Parks is given to George W. Stewart, a newspaper man of Visalia; Tipton Lindsey, former Receiver of the Visalia Land Office; John Tuohy, a sheep man, and Frank Walker of the Visalia Delta. An account of the struggles Stewart and his friends had to save the giant sequoias from the hands of locators is found in White and Fry's book "Big Trees". These two parks were proclaimed October 1, 1890, and six months later the Act of March 3, 1891 passed, giving the President the right to set aside forest reserves by proclamation. That law seemed to culminate the efforts of the conservationists led by B. Emerson and Franklin B. Hough and the American Association for the Advancement of Science. (This association got through a memorial to Congress in 1877 which resulted in the appointment of Hough as a Forestry Commissioner and finally, in the establishment of a Division of Forestry in the Department of Agriculture.) In reality it only opened a new chapter in the contest between the timber locators and the conservationists.

The "reserving" of anything in the way of large amounts of public land was revolutionary in those days. Since the 1860's the general trend of the public land policy was to get rid of it as fast as possible. The old expression "doing a Land Office business" was

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derived from the speed with which the public domain was disposed of. There were many groups of industrialists and promoters who were willing to meet the Government more than half way and among these were the lumbermen. With the passage of the reserve act it was perfectly plain they would have to get busier than ever. So, they went to work at once with what laws were then available.

The cause of practically all the old scandals involving public lands was the perverted use of laws designed ostensibly to aid in the settlement of the country. And the reason that land laws could be so manipulated is that there has been very little intelligent land use legislation by Congress in the last 75 years.

The locators of the Nineties had the homestead law which was intended to give settlers farms and homes in agricultural land areas; the Timber and Stone Act was intended to make it legal to use timber and stone in the Western states for mining and domestic purposes; the preemption law made it legal for squatters to occupy unsurveyed land and gave them a homestead claim in addition after that law had passed. All of these were based on the premise that these privileges were granted only to individuals and their families for their own exclusive and perpetual use. The idea was that every time the Government gave away 160 acres of homestead land it meant a new settler to help build up and feed the country. And when he or a miner took 160 acres of timber and stone land it was presumably for their sole use and benefit. The individual was provided for but the rugged individualist who was out to found an "industrial dynasty" and do something big was entirely overlooked, either unintentionally or otherwise.

To this day there are a few old timers in California who remember the orgies of the land locations of the early days. First came the timber cruiser to select the lands; then the "locator" who knew all the section corners; then the stage loads of the "land hungry" picked up in towns and cities. These dummies were taken to see the claims they were to file on and then filled out both a filing statement and a deed to land for which they received from \$100 to \$200. They had free rides, free grub and free booze for several days. The promoting agency attended to all legal details involving Land Office procedure and when patent issued the land belonged to a far sighted timber outfit. Some of the best of the timber lands in the sugar pine belt of the State originally cost the lumbermen from ten to twenty-five cents a thousand board feet.

When it came to acquiring big tree and redwood lands under the Timber and Stone Act the results were still more grotesque. The Hume-Bennett Company cut a group of gaint sequoias called the "Three Sisters." They were 22, 23 and 26 feet in diameter and contained an estimated 400,000 board feet. As lumber this group, which occupied an acre of land, probably netted \$4,000 counting breakage. Under the Timber and Stone law these trees brought the Government exactly \$2.50. As an exhibit of waste of natural resources and natural wonders and of inadequate land legislation,

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it was priceless. There does not seem to be any limit to the folly of the American people when it comes to land laws. Today they are being robbed of recreational land by means of the mining laws.

The timber locators also had the various kinds of land script which were warrants for the selection and patenting of public land. All of these different laws should have been enough to satisfy any ordinary appetite for land acquisition. But the land hunger grew faster than it could be fed and the greatest mistake of all was committed with the passage of the Lieu Land Act of 1897. This was primarily agitated by the railroads whose grants of odd sections on each side of the railroad right-of-way were included in many of the early forest reserves. They said they did not want to be surrounded by reserved lands so the new law gave them permission to exchange the included lands for an equal quantity elsewhere. They ceded all rights to these lands and took script in lieu of them. Soon after the law passed the Santa Fe Railroad turned in thousands of acres of chaparral covered land in the San Francisco Mountains Reserve and a large lumber company used this script to acquire high grade timber land in Idaho. This same law made it possible for lumber companies to cut the timber off of railroad land in the reserves and then exchange the denuded lands for standing timber outside the reserves.

In time, of course, all the remaining timber lands were protected by inclusion in the reserves. But so slow was the Government to create these reserves and so fast did the locators act that long before 1908 when, in California, the national forest area ceased to expand and eliminations began, private interests owned twice as much timber as that protected by the National Forests, and the private timber was more accessible and of far better quality. The Forest Service and the public have the leavings from the feast.

It is noted that the above information was obtained from a confidential source who has provided reliable information in the past.

The information was obtained from a confidential source who has provided reliable information in the past. The source has provided information regarding the activities of the National Forestry Association, which is a private organization that has been established for the purpose of promoting the interests of the National Forestry Association. The source has provided information regarding the activities of the National Forestry Association, which is a private organization that has been established for the purpose of promoting the interests of the National Forestry Association. The source has provided information regarding the activities of the National Forestry Association, which is a private organization that has been established for the purpose of promoting the interests of the National Forestry Association.

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FIRST TIMBER SALES

All the resources of the reserves were locked up tight for six years after the Act of March 1, 1891, which authorized their creation. After much public criticism of this neglectful policy Congress passed the Act of June 4, 1897, providing for the administration of these areas and authorizing the Secretary of the Interior to make rules and regulations for the protection and utilization of the resources of the forest reserves.

The earliest record of a Government timber sale on the reserves in California seems to be in 1899. In May of that year, the Peckinpah brothers who had a sawmill at Southfork, about a mile from Northfork on the Sierra Forest, petitioned the Commissioner of the General Land Office to sell them a little over a million feet of sugar and ponderosa pine timber at \$1.50 a thousand board feet for sugar pine, and \$1.00 for ponderosa. This application was approved by Supervisor J. W. Dobson and the timber was advertised at these prices which, according to Dobson, were higher than those paid to private owners for timber of equal value. There was nothing said about the fir and cedar mixed with the pine, and there were no rules about the conduct of the sale or any obligations on the part of the purchaser to leave the stand in a producing condition and pile the brush. It took so long to advertise this sale that a second petition was sent in, late in 1900, to buy the timber. Apparently, cutting began in 1901.

California was handicapped for some unknown reason in the early days of timber sales by having to advertise the sale of Government timber for 60 instead of 30 days, as in other states. The Act of June 6, 1900, amended that of June 4, 1897, and made it possible to sell amounts of timber less than \$100 in value without advertisement, and to allow cutting in advance of advertising, in emergencies. But here again an exception was made of California, which was not corrected until the Act of June 30, 1906, which made the Act of 1900 uniform in all states and territories except California. These discrepancies were not corrected until Appropriation Act of June 30, 1906, which made the provisions of the Act of 1900 uniform in all states.

Another stumbling block was the provision in the Act of 1897 which required that forest products cut from the forest reserves must be used within the state or territory in which the forest reserve was located. This practically prohibited sales of any size to large lumber companies who shipped their lumber out of the state. This was repealed by the Act of March 4, 1907, but in the meantime it had been treated in a very casual manner by both the Departments of the Interior and Agriculture. The Forest Reserve Manual of 1902 states "In the disposition of this material the local demand will have the preference, and in localities where this local demand is so great

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that all available timber is likely to be needed, applications involving the export of the material to distant points will be refused." This Manual went on to say that timber will be sold to supply local needs, either by being used in the vicinity or to maintain local industries." So it would seem that the export of timber was not specifically forbidden under certain circumstances by the Secretary of the Interior and forest reserve timber could be sold and exported if it benefited local industries. After the transfer of the reserves to the Department of Agriculture on February 1, 1905, the Forest Service made several large timber sales in California before the passage of the Act of 1907 without mentioning the export clause in the contracts.

CONTRACTS

There have been no revolutionary changes in the underlying objectives of timber sale contracts of 1902 and those of today, but there has been a decided development in the scope of contract requirements. The earliest contract forms were apparently printed in 1901 and contained 25 stipulations which stressed practices tending toward the protection and improvement of the forest stand. The first contract forms of the Forest Service were printed in 1905 and contain only 14 stipulations. The silvicultural requirements were about the same but were more condensed and up to date. The first forms are interesting because they show plainly they were written by men who were more familiar with the logging and timber practices of the Eastern and Lake States than with the West where the first reserves were located. One of the provisions was to the effect that no cutting shall be done in the summer months and there are mentions of dams, skidways, shanties, and other logging terms used in Maine and Wisconsin.

While the clauses of the old timber sale contracts were not so different from those of today, the methods and results of timber sale administration are decidedly in contrast. A study of the old files gives the impression that from 1902 until 1908 timber sales were a pain in the neck to both purchasers and the Government. Trained Federal officers were so scarce that there was no administrative personnel to carry out the provisions of the contracts. Purchasers showed a corresponding ignorance of and indifference to the terms of the contract which always led to trouble, and sometimes to litigation. The general attitude of the operators seemed to be that they did not intend to observe the rules and stipulations unless compelled to by forest officers.

This attitude may have been the natural dislike of the lumbermen and timber owners for an agency which put a stop to the private acquisition of Government timber lands. In addition they had been called many hard names by the pioneer conservationists. It may have been the result of custom and precedent for timber had always been cheap and easy to get since the country was first settled.

Until the Forest Service was created there was no agency which looked to the future welfare of Government natural resources or attempted to regulate the disposal and use of these resources for future generations. No doubt the timber purchasers felt that forest conservation was an unwarranted interference with industry and that contracts were only a matter of routine red tape to enable them to cut timber in the manner to which they had been accustomed. Strange to say this attitude persisted for many years.

No matter what may have been the actions of the old timber purchasers, the responsibility for the failures and mistakes of the early timber sale administration must be charged to the Government. Even if the purchasers chose to treat timber contracts as matters of small importance, it was emphatically up to the forest officers to use all legal means to enforce the contracts or stop the sale. . . The reason the officers did not compel compliance was because they did not know either the logging game or the principles of forestry underlying contract stipulations. Actually forest officers were in a tough spot in the early days. In any dispute over the terms of the contract they were up against the specious arguments of the loggers that the infractions were unavoidable and that the stipulations were impractical. In addition, the Forest Reserve Manual of 1902 contained a paragraph which said: "any incivilities or evident neglect on the part of forest officers which hinders the purchaser at his work or endangers his case by giving it the appearance of wilful or negligent trespass should be reported to the supervisor, and if not promptly corrected should be reported to the Commissioner of the General Land Office." The old timber sale men were evidently between the devil and the deep sea.

So it was that the business of selling timber from the forest reserves started with plenty of grief. Inspector H. D. Langille of the General Land Office said at the end of a discouraging report on the W. J. Doherty timber sale of 1902 on the Sequoia: "This is the price the Department is required to pay to initiate sales of public timber." He had found five specific things wrong with a little sale such as brush left unplied, stumps cut too high, merchantable timber left on the ground after logging, over cutting of the valuable pines and the leaving of the inferior cedar and fir, poor utilization of the tops of trees and damage to the trees left for a second cut. These were, for a long time, the main sources of trouble in the early timber sale contracts.

Under the General Land Office all timber sales were given a number and until the transfer of the reserves to the Department of Agriculture there had been seventeen sales made in California. If, as the records show, they began selling timber in 1902, there was not a large amount of business in three years. After the transfer development in timber sale technique was rapid because it brought into the picture educated foresters who were anxious to make use

of forest resources. There was not a great deal of difference between the General Land Office sale contracts of 1902 and the first Forest Service contracts of 1905, but change and improvements appeared in the next two years. The La Moine Timber and Trading Company's sale of 8-14-06, discarded the old printed form and wrote a contract on plain paper with 25 clauses, twelve of which were new. Most of the new stipulations dealt with better utilization, protection of the unmarked trees and advance growth, and this contract contained the first fire protection clauses. The operator, employees, and subcontractors were to do all in their power to prevent and assist in extinguishing forest fires; logging locomotives must use oil for fuel and donkey engines had to be equipped with spark arrestors satisfactory to the Forest Service. Just about a year later a stipulation was added in the Standard Lumber Company sale of 1-27-07 requiring fifty feet of hose on each donkey engine. The La Moine contract stated that all rigging should be slung on stumps or marked trees and that grab hooks should be used instead of wire chokers on unmarked trees. This last recommended by W. B. Greeley for the Madera Sugar Pine sale of 12-4-05 was not put in the contract.

Future timber sale stipulations were to expand mainly along fire prevention and hazard reduction lines and now make up a large part of the modern contract. Utilization, sanitation, control of insects and disease and supervision of logging and logging plans are other considerations which have been inserted or enlarged since that time. The old contracts left all brush burning up to the Forest Service; now the operator must furnish labor and also oil for brush burning.

All of these changes and developments will be easier to understand if the component parts of timber sale work and procedure are traced separately.

APPRAISALS

The Act of June 4, 1897, made it possible to sell Government timber in the forest reserves at not less than its appraised value and this rule has never been changed. This requirement made appraisals an important part of timber sale business from the beginning. The oldest timber sale reports in California are very sketchy as to any detailed methods of arriving at the value of the timber. Supervisor Harrison White of the Sequoia said in a report of 1902 "the price agreed on, \$1.50, is in my opinion a fair value; owing to the rough and rocky nature of the land the expense of logging is heavy." The acting Secretary of the Interior accepted this as a fair appraisal of the timber.

The instructions on page 14 of the Forest Reserve Manual told the supervisor or his assistant to go over the ground with the applicant and determine whether the timber should be sold, under what conditions, and at what prices. On page 39 of the Manual the

The first section of the report deals with the general situation of the country and the progress of the work done during the year. It is followed by a detailed account of the various projects undertaken and the results achieved. The report concludes with a summary of the work done and a list of the names of the staff members who have been engaged in the work.

The second section of the report deals with the financial statement of the organization for the year. It shows the income and expenditure for the year and the balance sheet at the end of the year. It also shows the details of the various projects and the amounts spent on each of them.

All the above mentioned matters have been dealt with in the report and it is hoped that the members of the organization will find it of interest and value.

APPENDIX

The first part of the appendix contains a list of the names of the staff members who have been engaged in the work during the year. It also contains a list of the names of the various projects and the amounts spent on each of them. The second part of the appendix contains a list of the names of the various projects and the amounts spent on each of them.

The third part of the appendix contains a list of the names of the various projects and the amounts spent on each of them. It also contains a list of the names of the various projects and the amounts spent on each of them.

price of timber is discussed further. It states that the price of stumpage should be decided, "not by general precedent in the region, but by the actual value of the timber as determined by its character, difficulty to log, and distance from market.---- The forest officer should determine the cost of marketing all material and recommend prices which will make it approximately equally desirable."

It was easier under that sort of procedure to let the purchaser set the price and then justify it in a report than to make a painstaking effort to arrive at a well calculated stumpage value. Consequently what reports can be found made in the Land Office days of the forest reserves are very perfunctory as to stumpage prices of timber.

The Forest Service took appraisals much more seriously. It was evident right after the transfer that an attempt was being made to find a formula for arriving at the correct value of stumpage. W. B. Greely's report on the Madera Sugar Pine case in 1905 and the report of P. T. Harris in 1906 on the La Moine application listed the entire manufacturing costs from woods to yard. They obtained their figures from the companies' books and also had the average selling price of lumber but there was no attempt made then to separate the lumber value by species and grades. The forest description was chiefly for the purpose of establishing rules for marking timber and as an aid to segregation of the trees into mature, decadent, thrifty or dead classes was made by Greeley when the timber was cruised.

The determination of lumber selling prices was one of the most important steps but this was not discussed in detail in the Manual. The special data which the California Region had to produce in order to make stumpage appraisals was to gather figures from lumber companies and loggers on the detailed operating costs and the selling price of rough lumber at the mill or the nearest shipping point. For use in appraisals the operating costs and selling prices for the past three years were averaged. To get at the different grades of lumber which could be manufactured from a proposed sale area Region 5 borrowed from Region 6 the practice of grading logs in three classes and then following these through the mill to see into what lumber grades they were cut. The field work, therefore, called for a cruise to show the estimated number and size of logs of the valuable species. The inferior species were not graded as closely. The computations necessary to find the estimated per cent of grades and amount of lumber which could be cut on a proposed sale and to finally set a stumpage price were long and involved but not mathematically difficult. When all the calculations were complete the stumpage prices were found by subtracting the sum of the manufacturing costs, depreciation, and margin for profit and risk from the average selling price of the lumber.

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III

EARLY DAY PERSONALITIES

One of the early appointees was Eugene S. Bruce, Expert Lumberman by title and practical lumberman by trade and experience. He was a member of the Forester's staff for many years where his intimate knowledge of logging and the lumber industry was influential in shaping the timber sale policies of the Service. In the same capacity in the California Region was J. C. Elliott who had been a scaler and superintendent of logging in the Department of the Interior. Jean Bruce induced him to take the civil service examination for lumberman in 1908 and for twenty-five years he was a valued advisor in the California District. Two other experienced lumbermen of that time were Patrick Kennedy and C. H. Ensign who came in about a year after Elliott and helped organize the first of the cruising jobs at the start of the timber inventory work. Another among these old time loggers who turned into foresters to the benefit of the Service was William G. Durbin, a cruiser and lumberman from West Virginia who took a job as field cook in the Bureau of Forestry in 1903--as he said in his autobiography-- out of curiosity. He remained to become a forest agent, timber sale man, deputy supervisor and supervisor until he was retired.

The Forest Service owes these men a debt of gratitude for their stabilizing influence in the early days of timber sales. Two conditions in particular made it almost impossible to conduct a timber sale through to a peaceful conclusion from 1902 onward for a period of years. There were the indifference of the purchasers to the terms of the contract and the crusading zeal of the Forest officers in enforcing those stipulations combined with their lack of experience in the lumber industry. It took men who knew the game, who could talk the language of lumberjacks in the woods and executives in their offices, and who were loyal to the Service, such as Uncle Joe Elliott and Bill Durbin, to straighten many an unhappy tangle when the Forest Service first started selling timber. Their firm, goodnatured diplomacy led the young foresters out of many a difficult situation and taught them that all lumbermen were not vandals by nature but are only business men who followed a code sanctioned by long custom.

The staff men in the Forester's Office who had charge of the early day timber management were Thomas H. Sherrard, William T. Cox, A. K. Chittenden, Phil T. Harris, and particularly W. B. Greeley who was in charge of timber sale work in California in 1906 and became supervisor of the Sequoia the latter part of that year. Harris was deputy supervisor of the Shasta from April, 1909 to May, 1911 and then transferred to the North Pacific Region.

The first chapter in the history of timber sales ended when the District Officers were set up as administrators of the national forests with all the authority necessary to carry on all ordinary business. The new chapter begins in December, 1908, when F. E. Olmsted was changed from District Inspector to District Forester. He had among his staff G. M. Homans and T. D. Woodbury as chief and assistant chief of Silviculture, G. W. Peavy as chief of Planting and F. R. Cooper as chief of Silvics. L. E. Hunt and C. Stowell Smith were chief and assistant chief of Products which, with Silvics, had charge of the investigative work in those days. One year from that time Silvics had been absorbed without trace, the three lumbermen were at work on projects in the national forests, and Louis Margolin and Swift Berry had been added to the staff. S. C. Smith was chief of Products and Carl Kupfer was assistant in Planting. In the third year after the District was established Woodbury was chief of Silviculture. Planting had been merged with Silviculture. Dr. E. P. Meinecke had been added to the staff by cooperation with the Bureau of Plant Industry as consulting wood pathologist and John M. Miller was Ranger-entomologist at Northfork.

The first part of the report is a general survey of the
situation in the country. It is followed by a detailed
description of the various regions and their
resources. The report then discusses the
problems facing the country and offers
suggestions for their solution. The
conclusion is that the country has a
bright future if the right policies
are followed.

IV

FIRE PROTECTION, HAZARD REDUCTION and BRUSH DISPOSAL

The earliest timber sale contracts of 1903 had fire protection clauses requiring the piling of brush but the first definite fire stipulations came in the LeMoine sale of 1906. The purchaser, the employees and subcontractors were to do all in their power to prevent and assist in extinguishing forest fires; locomotives must use oil for fuel and oil was specified for all main line machines such as loaders, cranes and skidders. Donkey engines had to be equipped with spark arrestors satisfactory to the Forest Service. A year later a stipulation was added to the Standard Lumber Company sale on the Stanislaus requiring 100 feet of hose on each donkey with either an ejector or steam cylinder pump. Locomotives and skidders had to have a pump and 50 feet of hose.

By 1911 the contracts were requiring the purchaser to clear the railroad rights of way and all donkey settings of inflammable material. From then until 1925 the additions to the fire protection clauses came gradually in response to the changes in methods and machines used in logging. By 1916 each donkey had to have a supply of 6 shovels, six axes and six barrels of water and in 1921 they had to have a sealed box in which to store these tools and have a watchman at the donkeys, or groups of donkeys at the noon hour during the danger season. Tank cars with 3000 or 5000 gallon capacity, depending on the width of the railroad gauge, with 1000 feet of 1½" hose were called for in 1923. In the next year's contracts there were several new clauses. Locomotives must sand the flues only at certain places where the right of way had been cleared for a quarter of a mile; a five gallon water back-pack with a hand pump was added to the equipment required on donkeys and all loading equipment; each camp cutting 60,000 board feet daily had to have a tool cache in a sealed box for fire only. The Forest officer in charge was authorized to close the sale down in times of excessive fire danger after two days notice to the operator. All donkeys had to be moved by locomotives so far as possible and if moved by their own power special precautions had to be used. One of these was to have the exhaust outside the stack and it was provided that all donkeys be equipped so that was possible when necessary.

After the severe season of 1924 Chief Forester W. B. Greeley decided to tighten up on the protection clauses in timber sales. He called a meeting of the California lumbermen in Sacramento in June, 1925, and submitted a new code which revised some of the old stipulations and added new ones. Among the innovations were a fire plan for each large sale; a patrolman for each large camp during the danger period; tool caches in the woods; portable gas pumps and 1000 feet of hose for logging camps with over twenty men and for small sawmills; the use of oil in the donkeys whenever on or within 300

feet of a main line railroad; training of sale officers in fire protection; no smoking except in camps and eating places and the control of fires built for lunch; tractors had to be equipped with a spark arrestor and a fire extinguisher of one gallon, which was later changed to one half gallon and then abolished altogether in 1936, a shovel being added as part of the equipment. Finally, the officer in charge had the authority to shut down all or part of an operation in times of extreme danger. This was later modified to provide extra patrol as an alternative, according to the judgement of the Forest officers.

These terms were accepted after some debate, mainly about the shut-down clause, and a study of spark arrestors started as a cooperative project between Forest Service, California Sugar and White Pine Association and the California Forestry Committee. Most of the work of this committee was done by S. R. Black, secretary of the California Forest Protective Association who continued to test and report on different makes of spark arrestors until 1928 when donkeys were being replaced by tractors.

The fire protection clauses of the timber sale contracts of 1937 are practically those of 1925 with minor modifications. They are no more numerically, in fact they are fewer owing to the passing of the steam donkey engine and the introduction of the gas and Diesel tractor.

Brush Disposal Experiments

With two exceptions the Forest Service has required the piling of all brush and debris left after logging operations on Government land in California national forests. These two exceptions comprise experiments in brush disposal whose results have not yet been determined with sufficient accuracy to warrant any change in policy.

In 1920 the Standard Lumber Company made a new sale on the Stanislaus for 147 million feet of timber in an area representative of the commercial pine belt of the Sierra Nevada. In 1923 the Forest Service took over the job of brush disposal through an agreement with the company whereby the Forest Service relieved the company of all responsibility upon payment of 30 cents per thousand board feet of timber cut under the contract. This furnished a fund of \$31,610 which the Forest Service budgeted for a thirteen year experiment in the use of fire lines, intensive patrols and other facilities as a substitute for brush piling and burning. These facilities consisted of a special lookout, primary and secondary firebreaks, special telephone system, a patrol and a supply of fire tools. The thirteen year period was selected as it was the estimated time necessary for brush, limbs and other refuse left from logging to disintegrate to a degree equivalent to the reduction secured through burning.

The plan was:

- (a) Pile and burn all inflammable refuse and debris in a strip 100 feet wide above all railroad grades.
- (b) Cut a trench 4 feet wide to mineral soil at the upper or up-hill edge of all breaks.
- (c) Burn strips 100 feet wide below all railroad bridges.
- (d) Clear all inflammable refuse from a strip 50 to 100 feet wide on the lower boundary of the sale area to aid in fighting fires originating outside the boundary of the sale in the river canyon.
- (e) Convert all railroad rights-of-way into motor ways after logging.
- (f) Regulate public use of cut over area in times of high fire danger.

The primary fire breaks followed the contours, secondary breaks were designed to run at right angles to the contours. These fire breaks and the railroad grades divided the sale area into seven compartments which varied in size from 200 to 900 acres. The secondary breaks were never completed systematically owing to excessive costs.

The result of this experiment from a protection standpoint has been even better, so far, than was anticipated. Compared with other units this area has had fewer fires and less acreage burned. This success is attributed largely to intensive patrol.

To complement the brush disposal project on the Stanislaus another one was started in 1926 on the Fruit Grower Supply Company sale on the Lassen where the topography, climate and timber are in contrast. The Standard area is fairly typical of the western Sierra ponderosa pine belt while the Fruit Grower area represents eastern Plumas and Lassen and the timber lands of Modoc-Siskiyou Counties. The Forest Service took the initiative in the Standard experiment, but the Fruit Growers promoted the one on the Lassen.

The Fruit Growers began a long term timber sale in 1921 and were under verbal agreement with the Forest Service to leave their own cut-over lands in a producing condition as part of a management plan for that region. Part of their obligations was in the disposal of brush on their private lands after logging. They tried two different methods in 1921 and 1922 and finally in 1923 adopted a method recommended by Assistant Regional Forester T. D. Woodbury which was practically the same as the Forest Service used in the Standard experimental area. Under the direction of the company forester they piled and burned all the inflammable material for 100 feet on each side of all main roads and railroads and ran lateral fire breaks so as to checkerboard the area into compartments where the brush was left unburned.

The first part of the report deals with the general situation in the country and the progress of the work done during the year.

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The report is divided into five parts. The first part deals with the general situation in the country and the progress of the work done during the year. The second part deals with the work done during the year. The third part deals with the work done during the year. The fourth part deals with the work done during the year. The fifth part deals with the work done during the year.

The report is divided into five parts.

The same year the experiment was started on the Stanislaus, 1923, Superintendent S. M. Bump asked Supervisor W. G. Durbin for a similar experiment of Government lands on the Fruit Grower area. This request was refused. In the meantime, the company continued the compartment method of brush disposal on their lands while using the conventional piling and burning on Forest Service lands. In 1926 the company submitted a firebreak protection plan and the company took over the entire work of brush disposal.

The agreement conditions called for:

- (a) A special lookout with telephone connections.
- (b) The clearing of skid roads within compartments after logging and a special fire trail around each setting of any machine.
- (c) The maintenance of primary and secondary breaks including cleaning the lateral trenches every three years.
- (d) Felling all dead trees after logging.
- (e) Clearing and converting railroad grades to motor ways.
- (f) Compliance with the timber sale fire plan.

The area was to be divided into compartments of not more than 100 acres; the primary fire breaks were to be 100 feet wide with all inflammable debris piled and burned and the secondary breaks were 50 feet wide and also cleaned of all debris. A four foot trench cut to mineral soil bordered each fire break. Within the primary and secondary breaks the saplings and small trees were trimmed to a height of five feet. On company land a more complete clearing was practised than on Government land. Within the compartment the tops were lopped and the brush left to disintegrate as on the Standard experiment. The agreement was to be in force until the slash danger had returned to normal, or the company could terminate it by reverting to the original system of brush piling and burning. This took place in 1932 after seven seasons of successful fire protection.

A full account of these two experiments in brush disposal is in the "Progress Report in Experimental Use of Fire Breaks within National Forest Timber Sale Areas in the California Region" of May, 1935.

THE DEVELOPMENT OF TIMBER MARKING
IN THE CALIFORNIA NATIONAL FORESTS

The art of Silviculture as expressed in marking trees for cutting was not an important part of the administration of the old forest reserves. In the manual of 1902 the chapter, "Care and Propagation of the Forest", said that the foremost point to be considered in a proposed sale of Government timber was the reproduction of the forest under various conditions, the young trees to be left and their seed-bearing capacity. As to marking trees, "the best methods of cutting must be decided, whether the trees below a certain diameter should be left, whether the surrounding timber will furnish enough seed, whether the cutting may be restricted or confined to strips- in other words, what system will be the surest to bring about satisfactory conditions." This rather vague instruction about methods of cutting and systems gives only the vaguest idea of what they are and it is certain that any field officer who was new to timber sale work would have had a most unfortunate time if he had to depend on these above. As a matter of fact they did have just such times not only under the General Land Office regime but also after the Forest Service took over the national forests. Timber marking has always been a controversial subject.

After 1905 the young technicians in the Forest Service were anxious to apply the knowledge of European systems of silviculture and forest regulations learned in forest schools. They did not realize then nor for the next few years that these rules, based as they were on the scientifically grown forests of Germany and France could not be applied to the wild woods and virgin forests of the United States. The Forest Service Use Book of 1907 discarded most of the European influences and recognized that the selection system, or some modification of it was the only one applicable to the forests of western America. Marking timber for cutting was said to be the most important part of a timber sale but it was made plain that the rules could not be applied as a whole in any specific case; they were only for general guidance and must be modified to suit different and economic conditions.

One of the earliest practices was to establish a diameter limit for a sale area. Theoretically, all trees above this limit were to be marked and all below it were to be saved. It was simple and might have been workable in the hand grown forests of Germany but it was never satisfactory in this country. The early timber sale contracts had a diameter limit specified and it was usually inferred by the purchaser that he was to get all the timber above that limit. He very seldom if ever did so and this was a cause of trouble. Another drawback was that the Forest Officers did not always agree among themselves as to just what the diameter limit should be and in our

forests it was very difficult to adhere to it and still leave a sufficient amount of timber on the ground and at the same time give the purchaser enough to make his operation profitable.

Instructions on timber marking were sent to the supervisor when a new contract was signed. One of the earliest of these was written by W. B. Greeley for the Fresno Flume and Lumber Company's sale of November 1, 1905. In the Madera Sugar Pine Company's sale of a month later, Greeley's report listed the trees according to their condition as thrifty, mature, decadent or dead. He established thirty-six inches as a diameter limit because he found that all the pines under that limit were thrifty. But he said that a large amount of discretion must be left to the marker on the ground. Both of these sales were on the Sierra Forest. The timber markers in those days were always the technical assistants whose forestry education were supposed to give them a grasp of the subject, particularly from the silvicultural angle, which could only be acquired in a school of forestry.

What might be called the prologue of timber marking occurred from 1902 to 1908 when the California District, now called Region, was established and the timber sale and research men began to develop rules for the forests of this part of the country instead of using those made for the country as a whole. From 1909 to 1918 there was a period of development and a new chapter began in 1919 with the advent of a set of Marking Principles for California national forests. A third chapter began in 1927 with the publication of a Tree Classification by Duncan Dunning which utilized all the past practical experience and the scientific data which he had gathered from measurements of sample plots in the timbered forests of the State.

Development of Marking, 1909 to 1918

One of the first big jobs of the branch of Silviculture in the Forester's office was the preparation of marking rules for all national forests where they would be of practical benefit. The idea was to have these rules as specific as possible but yet sufficiently general to be applicable to future sales. They were going to take each forest type and made the rules consistent with the condition and the present and future demand for the timber of the different types. In May, 1908, the Forester sent out general instructions for the southern division of the Western Yellow pine, (*Pinus ponderosa*) and for the Sugar Pine region. The main points were to mark for another cut in about thirty years and William T. Cox, Assistant Forester, told Supervisor Earnest Britten of the Mendocino (then the California) that not less than one third of the present stand of merchantable timber should be left on the sale area. The selection system was to be used and all fir and cedar should be cut to small diameters. Also the rotten trees of these two species were to be cleaned out. The next issue of general rules came out in 1912 when the Forester sent out silvicultural systems

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Development of Warrenton, Oregon

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for the Ponderosa pine which attempted to standardize the management plans for this species. District Forester duBois sent this out to the supervisors for comment and in July of 1912 told the Forester that marking on paper and in the woods are two very different things; two persons might agree on a paper policy as to what trees to mark but would disagree when they were in the woods.

That statement expressed the practical experience of the California Region as to timber marking. It had been found to be one of the most controversial of all subjects between forest officers and with timber purchasers. There had been so many complaints from operators that they had been misled in the amount of timber they should get from a sale area that Assistant District Forester Woodbury inaugurated the practice of sample marking in July, 1910. This scheme consisted in having the forest officers mark a representative area of sufficient size to give the prospective purchaser an idea of how the Forest Service was going to cut the entire area. The applicant was taken over the ground and then signed a statement in his application that he had examined the marking and found it satisfactory. In March, 1911, the Forester recommended this as standard practice for the entire Service.

About the time sample marking came in a new agency was suggested by the Forester's office--a marking board. The marking boards were local affairs and had the job of examining all important timber sales each season and criticizing the marking and other items of sale administration. There was no such board in the California region in 1910, but two years later a marking board with different functions was organized. It happened that the Sierra Sugar Pine Company had made application for 800 million feet of timber on the Sierra Forest and naturally the sale of such an amount of Government stumpage required careful handling. District Forester duBois invited W. B. Greeley, Chief of the Branch of Silviculture to come out to California and help with the sample marking. The result was a marking board composed of Greeley, duBois, Supervisor P. G. Redington, and Forest Assistants C. L. Hill and E. G. Dudley. This board marked 72 acres and kept a record of the trees of all species which were cut or left. It was this occasion when the group selection system was first brought forward as a possible answer to some of California's marking problems. The main effect of this system was to leave intact groups of thrifty even-aged trees usually under 30 inches in diameter breast high. Their report came out in November 1912. The group selection system sounded good at first but it was discarded in 1924 after twelve years of trial. It had been the practice to thin out such groups to secure increased growth, now it was felt that in most cases such thinnings might damage the remaining trees and it would be inadvisable silviculturally to remove them as they were in the stage of the most rapid growth.

Two items of marking policy which were approved by that marking board seem strange today; one was the cutting of trees found

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The second part of the document details the internal control system implemented by the organization. It describes the segregation of duties, the authorization process for transactions, and the regular reconciliation of accounts. The document highlights the effectiveness of these controls in preventing errors and fraud, and provides examples of how they are applied in various departments.

The third part of the document focuses on the financial performance of the organization over the reporting period. It presents a comprehensive analysis of the income statement, balance sheet, and cash flow statement. Key metrics such as profit margins, return on assets, and liquidity ratios are discussed, along with the reasons for any significant changes compared to the previous period.

The fourth part of the document provides a forward-looking perspective on the organization's financial strategy. It discusses the planned investments, capital expenditures, and debt management for the upcoming year. The document also addresses the potential risks and opportunities that may impact the organization's financial health and offers recommendations for mitigating these risks.

In conclusion, the document reaffirms the organization's commitment to financial integrity and transparency. It expresses confidence in the accuracy of the reported financial information and the effectiveness of the internal control system. The document serves as a key reference for stakeholders and provides a clear overview of the organization's financial position and future outlook.

encroaching on the small meadows scattered through the forest on the theory that these areas were of agricultural value and would eventually be cleared for farming; the other strange idea was the wishful thought that all fires were going to be excluded from timber sale areas so whenever they thought the advance reproduction was sufficient, all mature trees were marked for cutting instead of saving some of them as insurance. The board saved about one third of the total stand for a future cut. This percentage was also to be changed back and forth in the next two decades.

Although the Forest Service had taken in practical lumbermen and professional woodsmen such as Jean Bruce, Uncle Joe Elliott, Pat Kennedy and Ensign, men who were familiar with logging operations, it still clung to the idea that only technical men should have the say in marking timber for a sale. There is no doubt but that an intelligent man with a forest school education can supplement his technical knowledge with practical lumbering and become an all-around forester. But to fail to use the practical knowledge of expert lumbermen when it came to marking timber was a mistake which seems strange in retrospect. In October 1913 it finally dawned on the District Office that they were over looking a bet and a memorandum was written the supervisors that practical lumbermen should be part of the marking crews.

This change of heart in regard to the woodsmen was brought about by the realization that the Forest Service had to have some understanding of the mechanics of logging in order to do a practical job of timber marking. At that time the era of donkey logging was just starting to boom into bigger and better- and naturally more destructive- logging machinery. The day of chute logging was beginning to wane with the introduction of powerful donkeys and high leads. In the best operations the hook tenders stopped working with their hands and took to planning their donkey settings and overseeing the complicated organization under their command. As the memorandum stated; "The relation of marking to logging begins with the location of the donkey sets and the location of the line leads and bull blocks. With these known, it may be found necessary either to cut or leave certain trees of the doubtful class because they either can or can not be felled in line with the direction they must move in going out. Damage to the remaining stand, especially in sapling and pole growth, is where the relation between marking and logging is most important. With the location of donkey sets and line leads known, it is possible to mark so as to concentrate damages in fewer trails and also cheapen the cost to the operator. For the marker to have this knowledge, close cooperation between the woods foreman and the forest officer is essential. - - - I want to emphasize the need of having the lumberman or ranger in charge of the sale with the marking crew. In my mind, the ideal marking crew would be the forest assistant, the officer in charge of the sale (preferably a lumberman), and the operator's woods superintendent; this crew to work just as little in advance of the loggers as possible. From this time on timber marking was a combination of silviculture and

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practical logging. In later years lumbermen Bert Hurt of the Sierra and W. S. Price on the Stanislaus developed this cooperation between the logging bosses and the timber sale men with outstanding success. In April 1916 the Forester issued a circular letter giving the timber sale policy and procedure and in the section of this letter on marking it is found that marking boards are an official institution. They functioned only in large sales and were composed of a representative of the District Office of Silviculture, the supervisor, timber sale man and a representative of the purchaser who understood logging. The marking principles were (1) improve the condition of the forest, (2) harvest the ripe timber, but do not require unwilling operators to remove thrifty trees of the inferior species, (3) give the purchaser enough timber to make his operation profitable, (4) cut all trees which will interfere with the approved logging plan, (5) leave knotty thrifty trees, leave malformed trees which will not cut out one log with an 18 inch top diameter, (6) cut the diseased and deteriorating cedar and fir, (7) consider the aesthetics when marking near camping spots, roads and other places where tourists gather, (8) mark for a second cut in from 50 to 75 years. Originally the first cutting cycle was to be 30 years; now it was raised and with it the average per cent of the of the volume of the total stand to be cut rose from 70 to 80 per cent.

It was about this time that the lumbering industry began to feel the beginning of the World War boom and the effect was apparent in Forest Service timber sale business. Southern lumbermen whose holdings were depleted began to look for long term investments and turned toward the Pacific Coast. The rising price of lumber brought fruit growing association such as the citrus and peach growers into the lumbering game. The volume of timber sale business in the national forests brought new developments.

In November 1918 Mr. Woodbury called a meeting of all timber sale men in the District at the Feather River Experiment Station of the Plumas to discuss a new tree classification which would have an effect on the marking rules. It was appropriate to hold this meeting on the Plumas for Supervisor D. N. Rogers and his staff first suggested and then had tentatively worked out this new scheme. Briefly, it divided trees into two broad classes-"black jacks" with conical or pointed crowns and round or flat top trees; the latter group was divided into "mature," "decadent" and a new class called "thrifty mature." These classes were described as to their external appearance so that there would be no doubt in the markers mind. Marking could then be simplified by eliminating from consideration the thrifty "black jacks" which should never be marked except for some unusual reason. The mature and decadent trees should always be marked. This left the new class, "thrifty mature," to be dealt with which was the one always causing complaints and controversies. During the winter of 1918-19 Assistant District Forester Woodbury assisted by research expert S. B. Shaw worked over the marking problems and came out in February with a set of Marking Principles for the national forests of California which marked a new era in timber marking.

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The Art of Timber Marking

Former marking instructions sought to guide the marker under all or almost all of the conditions found in the average timber sale area. It is an impossibility to cover all conditions; for each sale presents a new problem and the different parts of the same area have a new aspect. The most important development in the new principles lay in leaving it up to each marker in the field to determine his specific problems and work them out by applying the principles outlined. There were to be no more detailed instructions which were open to misconceptions and the cause of serious mistakes. According to the statement under policy in these new marking principles: "Marking timber is an art. In this work the forester has an opportunity to give expression to the sum total of his judgment, knowledge, skill and experience. The importance of this work cannot be overemphasized since the results are lasting and far reaching. Our names will be identified with areas marked long after we have passed out of the field of action.---That the success of marking depends absolutely upon the skill of the marker to choose trees for leaving which will serve the purpose for which they are intended is axiomatic and must be clearly recognized." So it was that timber marking was taken out of the class of unimaginative sciences and made into an art in which the marker could express his individuality. Woodbury used the new tree classification brought out at the Plumas meeting and recognized two site classes--good sites where the selection and group selection systems were to be used and poor sites which should be cut clear except for thrifty trees. The objects of marking were simplified to four--(1) harvest ripe timber, (2) secure reproduction after cutting, (3) accelerate growth of reproduction and young trees left, (4) make timber purchasers operation profitable.

The mention of site classes was the key to the next development in marking. Woodbury's study had stressed the dominating importance of site quality as against timber types which had formerly controlled marking rules, and had been the cause of some serious marking blunders. The significance of the difference in yield of timber between the different sites had not been understood or taken into consideration in the early marking rules. By 1922 there had been more than ten years study of cut-over areas to determine the effects of cutting on the remaining growth and on reproduction in order to modify marking practice as the results dictated. In addition there were 25 sample plots varying in size from 6 to 24 acres totaling 300 acres and involving measurement of 17,500 trees every five years. These plots were located on the Shasta, Lassen, Plumas, Tahoe, Stanislaus, Sierra, and Sequoia Forests. Two periods of five years had elapsed and the results had been studied by Duncan Dunning of the research branch of the District Office. In February 1922 he issued a paper, "Some Results of a Cutting Study in California," which was a concise summary of the scientific results of this study.

This was published as Department Bulletin #1176 and was issued in January 1924 to the California supervisors with a letter from District

The first part of the report deals with the general situation in the country. It is noted that the economy is in a state of depression, and that the government is unable to meet its obligations. The report then goes on to discuss the various causes of this situation, including the effects of the war, the loss of the market, and the inflationary pressure. It is pointed out that the government has tried to deal with these problems by increasing taxes and reducing expenditures, but that these measures have not been sufficient. The report then discusses the various proposals for dealing with these problems, including the possibility of a new currency, and the possibility of international assistance. It is concluded that the government must take more radical measures if it is to deal with these problems.

The second part of the report deals with the financial situation. It is noted that the government has a large deficit, and that it is unable to raise the necessary funds to meet its obligations. The report then discusses the various sources of government revenue, including taxes, and the various methods of raising these funds. It is pointed out that the government has tried to raise funds by increasing taxes, but that these measures have not been sufficient. The report then discusses the various proposals for raising funds, including the possibility of a new currency, and the possibility of international assistance. It is concluded that the government must take more radical measures if it is to deal with these problems.

The third part of the report deals with the social situation. It is noted that the population is suffering from poverty and unemployment, and that the government is unable to meet its obligations. The report then discusses the various causes of this situation, including the effects of the war, the loss of the market, and the inflationary pressure. It is pointed out that the government has tried to deal with these problems by increasing taxes and reducing expenditures, but that these measures have not been sufficient. The report then discusses the various proposals for dealing with these problems, including the possibility of a new currency, and the possibility of international assistance. It is concluded that the government must take more radical measures if it is to deal with these problems.

Forester Redington. He emphasized a few of the outstanding conclusions reached. One was that the so called group selection system was a failure from a silvicultural standpoint; instead of leaving groups of Ponderosa pine they should be thinned in order to secure increased growth and for seed production; groups could be left to prevent injuries with donkey logging on rough ground. The importance of advance reproduction was stressed because it was found that it took from ten to twenty years to secure a fair stand of reproduction; this should be protected during logging operations and marking should be designed to release well established young growth from light and root competition.

Redington called attention to the fact that up to that time marking principles had been dealt with almost exclusively from the standpoint of the best silvicultural practice but during the past few years the realization had come that in every practicable case the cutting should be planned and regulated so as to insure continuous lumbering operations. "From the standpoint of sound policy it is evident that we should strive toward sustained yield management. The Forester has definitely expressed the policy of conservative marking to the end that a substantial reserve of merchantable size material shall be left on every cutting area." This reserve stand was to be from 15 to 20 per cent of the volume of the merchantable stand and where there was not enough thrifty trees the balance should be in the thrift-mature class. This 20 per cent leave was not as much as was being left when the Service first began selling timber, and the next cut was figured on within 40 to 70 years instead of 30. The reason behind this talk of sustained yield was a congressional Capper Committee report on the status of the timber supply of this country.

It was about this time, January 1924 when the Forester proposed an innovation which had been tried out in the Eastern forests and for a short time on the Lassen, that is the marking of trees to be left instead of the trees which should be cut. In the opinion of the California district this practice was unsatisfactory and the standard practice of marking trees for cutting was approved. Also in that year the Forester proposed to make a motion picture of good and bad timber sale administration for the education of forest officers but the big fire season in California postponed that project indefinitely. Apparently nothing of importance happened in the history of timber marking during 1925 and '26 because the next important event was the publication of Dunning's new Tree Classification.

From 1927 - Tree Classification

Since 1919 the tree classifications of thrifty, mature, thrifty-mature and decadent had been in effect for timber marking. In April 1927 Duncan Dunning, Silviculturist of the California Forest and Range Experiment Station brought out his study, "A Proposed Tree Classification for the Selection Forests of the Sierra Nevada with Special reference to Western Yellow Pine." By this time Dunning had three five year periods in which to study the measurement of tree growth

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on the twenty-five sample plots of the District and this was "an effort to segregate into groups the trees with certain combinations of factors known from previous studies to have similar influence on growth and seed bearing." He took only the Western Yellow or Ponderosa Pine for his study and considered only trees with some merchantability on the theory that diseased and insect infested trees would be cut under any circumstance. Instead of four classes he made seven based on the dominance of the tree in the stand and the size and shape of the crown.

The new classification was an elaboration of the old one based on actual growth figures and other data. Dunning's main plea was for an individual consideration of each tree, or rather a recognition of the fact that each tree was an individual with special characteristics. He did not offer this as the solution of all marking difficulties for "whatever system of tree grouping is used in marking it is not to be expected that there will be perfect agreement among men. But adherence to a definite system of appraising each tree--- will prevent obvious mistakes in marking, raise the average rate of growth in cut-over stands, decrease losses and improve the quality of the seed trees ." His classification gave a solid foundation on which to appraise trees as to their value as seed bearers, as future producers of wood and as to their chances of surviving attacks from insect or disease. This new classification became popular with the field men at once and within a year timber markers and timber sale men were referring to trees by Dunning's number classification. It was planned to print it as a Departmental bulletin, but there was some hitch and it finally came out in October 1928 as a reprint from the Journal of Agricultural Research (Vol. 36, No. 9). It was officially adapted in March 1928 for the California Region when it was stated that while the classification was applicable to Ponderosa pine, it could be applied with reasonable success in marking any of the commercial species.

A summary of the new classification is, Class 1- thrifty-dominant, trees superior to all others; Class 2 - thrifty co-dominant, slower growing than Class 1; Class 3 - mature dominant, thrifty trees in the mature class comparable to the old thrifty-mature; Classes 4 and 5- mature codominant and over-mature codominant; Class 6- thrifty intermediate, trees which give promise of growth if released; Class 7-over-mature suppressed.

In 1928 the Forest Management Handbook was revised and an important change of policy in regard to inferior species was made which had an effect on marking. "Inferior species of low value will not be pushed on the market in advance of recognition of their real worth and usability by consumers. ---Except in cases of serious deterioration, areas containing species whose market value is little, if any, more than the cost of production will be reserves from sale---. Where stands of mixed species are

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marked to secure a second cut, thrifty growing trees of inferior species, will as a general rule, be cut no more heavily than similar trees of the valuable species." This reduced the cutting of cedar and red and white fir except the over-mature diseased and decadent trees.

At this time special marking rules for the Jeffrey pine type, Eastern Lassen and the same type in the San Bernardino were given to the supervisors.

The practice of check marking--the recording of the trees cut and left--in connection with sample marking on large timber sales had been carried on prior to 1919. In recent years it had been discontinued sometimes to the disadvantage of consistent marking practice. It was requested that this custom be revived and a check marking record be made every thirty days on all advertised sales. At this time the cut on most sales amounted to 80 per cent of total merchantable volume of the stand.

That brought timber marking and timber sale business up to about 1930, the first year of the big depression. From then until 1936, the timber management has not needed much attention or many rules. Now, however, there is to be a swing towards more conservative marking and an even larger per cent of the stand is to be saved than when the first timber was sold over thirty years ago.

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DEVELOPMENT OF LOGGING METHODS AND EQUIPMENT
IN THE CALIFORNIA FORESTS

Timber management in the national forests has always been related to logging equipment and logging methods. The silviculturist may have worked out his system of what trees to leave and cut by research, but the timber sale man must keep one eye on the type of machinery used by the purchaser. If with certain types of equipment certain trees are sure to be injured, it is good sale practice for the timber sale man to mark these trees to be cut even though the silvicultural rules say they should be left.

The history of timber sale administration in the California Region is largely a record of the growth of accurate knowledge about our trees and our ability to adjust timber marking, fire protection, and general sale regulations to changing logging equipment and the consequent changing methods used by operators. Some of the developments in logging machinery and methods have not been important to the Forest Service as they have had little to do with sustained yield. How logs were loaded on cars, trucks or other vehicles did not make much difference. But how they were taken from the stump to the vehicle or to the mill has always been of great importance.

To get a background for the story of the development of logging machinery and methods before the creation of the national forests, the most reliable records are the accounts of the proceedings of the Pacific Logging Congress as reported in the files of the Timberman Magazine. During the course of the annual meeting many papers were read by pioneer lumbermen giving authentic accounts of the early days.

According to the revised Capper Report of 1931 the redwood region of California was the scene of the first commercial lumbering and was also where some of the developments in logging first took place. The Russians at Fort Ross built a sawmill in 1818, but the lumber was used only for the building of their colony including the church which is still standing. Before the discovery of gold, sawed lumber was produced at Bodega in 1835, Sonoma County, and soon afterward at Tocaloma, Marin County, both of these points being in the redwood country just north of San Francisco. Logging in the Santa Cruz redwoods also began about this time.

Horses were scarce at that time so they put the old ox teams- perhaps some of them had come across the plains- to work. Skid roads, a sort of semi-corduoy affair taken from the Lake States, were built where the soil was soft and where the stand of timber warranted the investment. Where the timber was scattered they rebuilt the farm wagons into logging trucks or imported the big wheels from the South although they were invented in Michigan about 1860 according to Stewart H. Holbrook in the American Forests Magazine. Probably the first saw mill in the pine region of the State was Sutter's water power mill at Coloma where James Marshall found gold in 1848 and changed the course of California history. The sudden increase in population after this event caused a proportionate growth in the lumber industry.

The first part of the book is devoted to a general introduction to the subject of the history of the United States. It covers the period from the discovery of the continent to the beginning of the American Revolution. The author discusses the early exploration of the continent, the establishment of the first colonies, and the growth of the American people. He also touches upon the political and social conditions of the time, and the role of the British in the development of the colonies.

The second part of the book is devoted to a detailed account of the American Revolution. It covers the period from the outbreak of hostilities in 1775 to the signing of the Declaration of Independence in 1776. The author discusses the military and political events of the war, the role of the Continental Congress, and the impact of the war on the American people. He also touches upon the social and economic conditions of the time, and the role of the British in the development of the colonies.

The third part of the book is devoted to a detailed account of the American Revolution. It covers the period from the signing of the Declaration of Independence in 1776 to the end of the war in 1783. The author discusses the military and political events of the war, the role of the Continental Congress, and the impact of the war on the American people. He also touches upon the social and economic conditions of the time, and the role of the British in the development of the colonies.

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Until about 1926 there were two fairly distinct zones of logging development in California; the fairly level country with open or scattering timber such as it found in parts of the Plumas and Lassen region, the Modoc and Shasta Forests and the thick heavy timber found in the rough topography of the redwoods and the central Sierra region from the Eldorado to the Sequoia. Both started with bull teams and horses and developed along different lines to finally merge with the perfection of the tractor and arch wheels. It will be easier to follow these two types separately.

Easy Ground and Open Timber

There were many different ways of logging easy ground with slopes less than 12 per cent. Swift Berry's report for 1912 tells that the Durley and Herrick sale on the Plumas used two methods depending on the distance from the mill. On a mile and a quarter haul they used slip tongue wheels and on a longer haul they used six horses hitched to a log truck. The McCloud River Lumber Company had two camps with seven pairs of big wheels at each camp in 1912 and also a camp with only donkey engines. The horse loggers and the steam lumberjacks often had hard names for each other. The McCloud Company used the stinger or stiff tongue wheels like those from the Southern States. The slip tongue were the most popular as the load was automatically lowered to the ground to act as a brake when going down hill. They were usually larger and heavier than the stiff tongue wheels requiring four horses instead of two. They could carry a larger load but required more swamping. Two other large operators used practically the same system as McCloud having both wheels and donkeys; Red River Lumber Company and Fruit Growers Supply Company at Susanville. Wherever possible these operators used wheels as they were cheaper than any other method. The very efficient Weed Company of that time used wheels entirely. The limiting factor was the length of haul which the loggers tried to keep about 1000 feet but longer hauls with wheels were used in small operations.

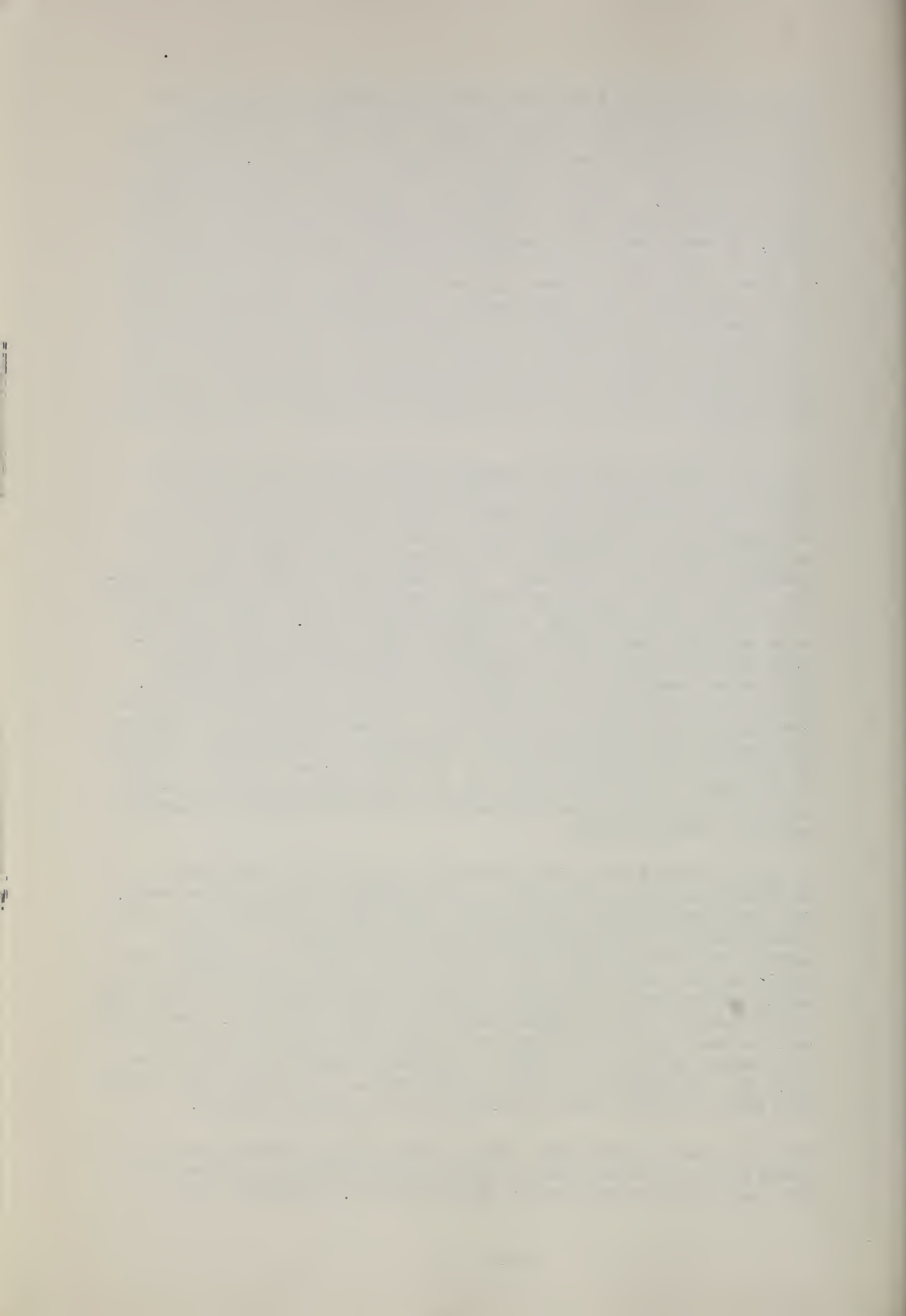
There were two operations connected with wheel logging which bothered foresters - swamping and bunching - because of the possibilities for the destruction of young trees and reproduction. After the trees were felled the swampers cleared roads for the wheels. In open ground with little second growth this was not an important job. But where there was a heavy growth of seedlings and young trees, it meant that a large percentage, sometimes over half of the ground area, was cleaned of all reproduction. After the swampers came the bunching operation which consisted in breaking the logs apart and rolling them together in bunches for the wheels to pick up. So long as only horses were used in bunching there was not much damage, but when gasoline tractors came in there was a lot of reproduction destroyed by turning and maneuvering. Whatever the disadvantages there were to horses and big wheels, the Forest Service recognized that they lessened the fire risk, and if they did destroy reproduction and small trees, they did much less damage to trees over 12 inches in diameter than donkey logging.

For an account of the introduction of mechanical power in wheel logging the following facts have been taken from the paper by J. W. Hill at the 1917 Pacific Logging Congress. Mr. Hill was an official of the Holt Manufacturing Company of Stockton, since merged with the Best Tractor Company in what is now the Caterpillar Tractor Company. The Holt Company was primarily engaged in making farm machinery, but just as the farm wagon was converted to a log truck, so was some of the mechanical power used in farming converted to the needs of the lumber industry. The first application of power, other than horses and oxen, was steam. The steam tractor was in use twenty five years before the internal combustion engine was a practical reality, and the steam tractor was an outgrowth of the steam threshing machine. These could haul heavy loads of logs to the mill or lumber to the shipping points and, in order to help out on adverse grades, the Holt Company made an auxiliary engine unit mounted on the axle of the wagons and operated with steam from the tractor.

The Holt Company owned the patented "caterpillar" name, and the story of the invention of the caterpillar track is given by Mr. Hill. They were building a steam tractor for use in the soft reclaimed lands of the San Joaquin Valley and needed wheels which would give lots of traction. The first set were eight feet in diameter with a six foot face. But these did not give enough traction, so the Holt people kept adding extension wheels until they had three sets, making 18 feet of wheels on each side. This resulted in an awkward, heavy affair. Benjamin Holt, looking it over, decided that he would put a caterpillar track under these wheels, and the new combination was called the Father of the caterpillar. When it was perfected, a caterpillar tractor with a track 20 inches wide had the same tractive support as a wheel 169 feet in diameter; its pressure per square inch was from three to seven pounds compared to 14 to 18 for a person and 20 to 35 for a horse. At that stage of the game the tractor people had to convince the dyed-in-the-wool horse loggers that there was something more efficient than animal power for wheel logging.

It is difficult to say with certainty when and where the first mechanical tractors were used as a substitute for real horse power. The Timberman magazine for October, 1919 gives an account of a gasoline tractor of the caterpillar type manufactured by the Holt Company of Stockton being used for a year or more by a logging outfit in Idaho. Of course both the Holt and Best Companies had been making steam tractors for years which had been used in the woods and on the farms. But the steam tractor was not, or had not, been developed to take the place of horses on jobs like hauling big wheels. As a matter of fact, the first gas tractors used in California were built for agriculture and not for the woods. It was not until after 1920 that a special type was adapted to the lumber industry.

There is a note in the files that a Linn tractor hauled some log trucks for the Durham Lumber Company of Brownsville, California in 1920, and a letter from Forest Assistant E. C. Goldsmith that a

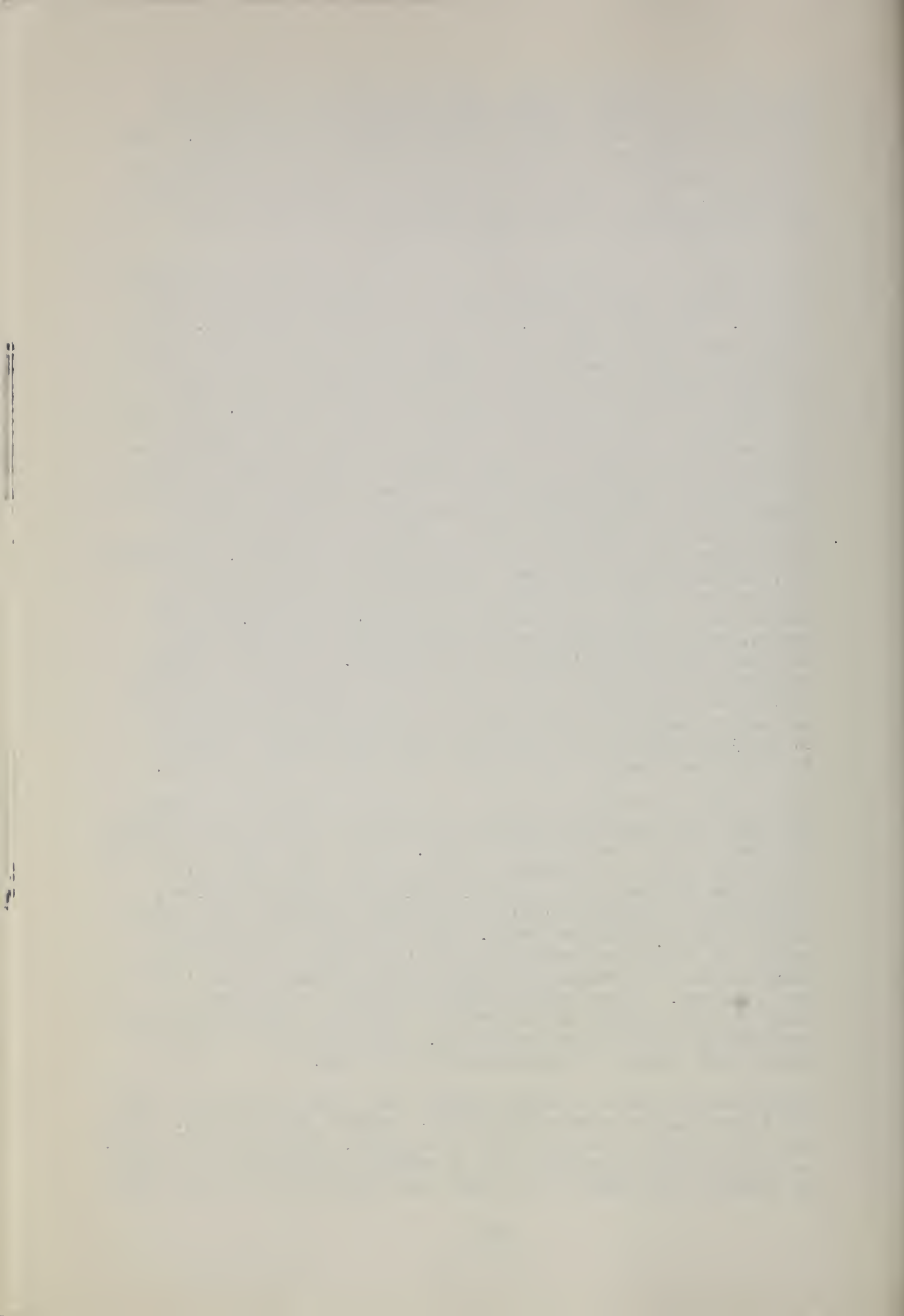


Holt "45" caterpillar tractor, built for farm use, was used for logging by the Schmitt brother near Gazelle, but in both cases the gas tractors were used on the road and not in the woods. Also in 1920 the Timberman carried an article about a 60 horsepower tractor designed for the woods by the Best Company of San Leandro, California. It was called a "tracklayer" in distinction to the Holt "caterpillar", a trade name acquired by the Best concern when it bought out the Holt company in 1926.

About 1921 it was advertised that the day of the horse was passing in the logging camps; gasoline power was cutting the cost of log hauling. Lumberman Vance S. Brown in a report of March 14, 1924 stated that Lassen Lumber and Box tried out Holt, Lest and Monarch tractors with big wheels in the summer of 1922, but the machines were not powerful enough and there were no expert drivers and mechanics available so the experiment was not a success. By 1924 the following lumber companies had tried out tractor logging: Davies-Johnson, Calpine; Clover Valley, Loyalton; Otey McKee contractors on the Lassen and Plumas Forests; Lassen Lumber and Box and Red River Lumber Company on the Lassen Forest. By that time the Forest Service believed that gas tractors as a logging method lessened the fire risk and did less damage to reproduction and young trees left on the area than other forms of logging. The operators, thinking mainly of costs, believed that they had found a cheaper way to log. They found that tractors and wheels could log slopes as steep as 30 instead of 12 percent with wheels and horses, and if they discarded the wheels they could skid logs with the tractors on slopes up to 45 percent. It was the history of machinery repeating itself. Once it was found that a certain kind of an engine could do a certain job to any degree at all, it was only a question of time before the machine was perfected to do the job cheaper than it had ever been done before. Within a few years gas tractors had replaced the horse in wheel logging.

Almost with the first use of the gas tractor with the big wheels, the smart boys among the equipment manufacturers got busy to change the wheel to fit the new motive power. First there was the Glascock wheel made by the Holt Company, which was the old wooden horse wheel made of steel with a special device for raising the load, consisting of a toothed tract on the tongue instead of the "gypsy" shaft on the slip tongue wheels. This new gear was not strong enough and also there were defects in the design which made them impractical. The Robinson Hydraulic Wheel, brought out in 1923 was a success. It was built large and rugged for any sort of rough work and raised and lowered the load by an oil hydraulic lift operated by the motor on the tractor. The Timberman of July and August 1923 carries a description of this wheel.

There were two parts of wheel logging which both the operators and the Forest Service wanted eliminated - swamping and bunching. They cost the operator money and they were liable, unless carefully done, to cost the Forest Service a lot of advance reproduction. As soon as tractors were made so that they could navigate over steep, rough

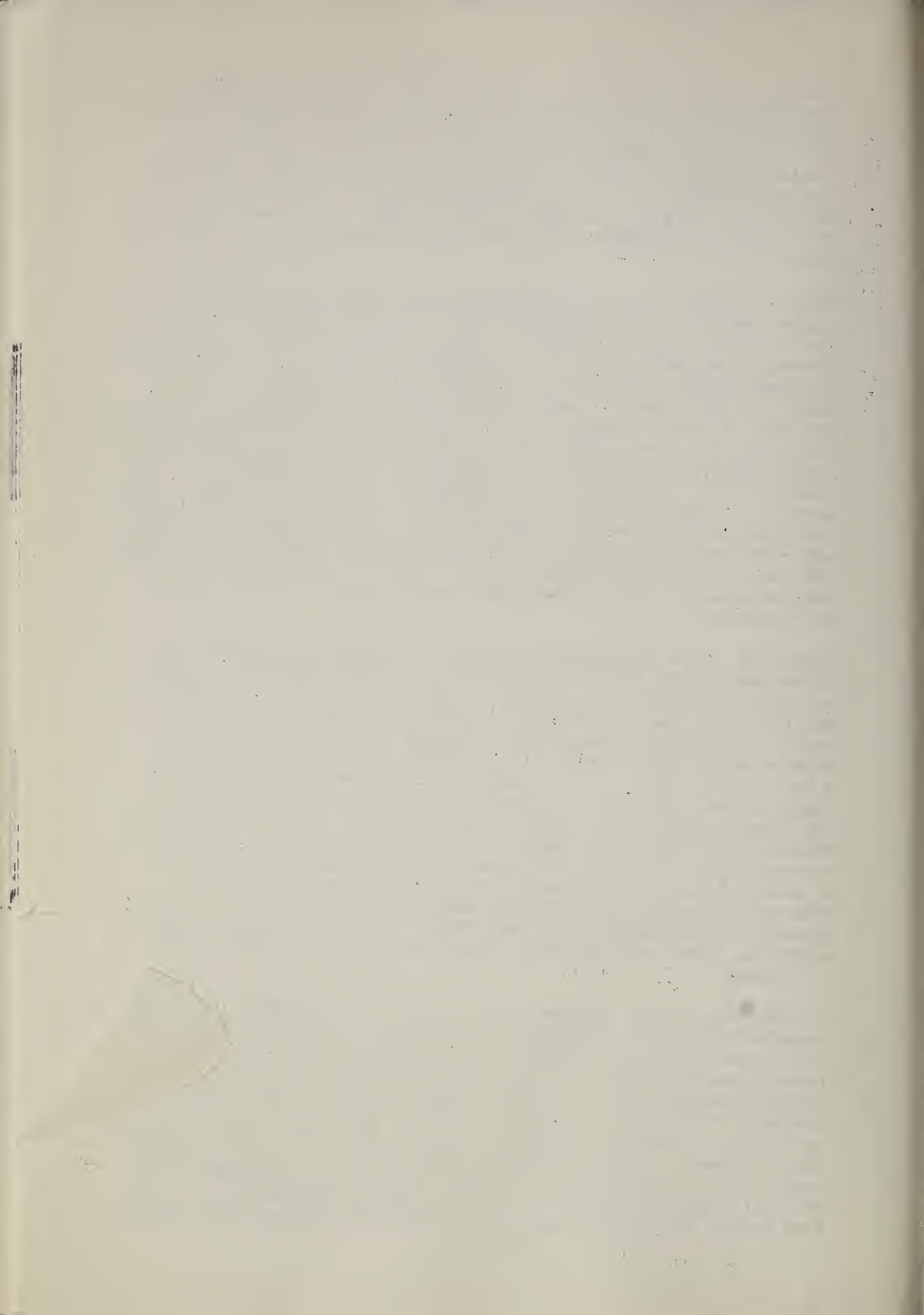


country, they took a couple of chokers into the woods and hauled back two or more logs depending on the size. Some bunching was necessary for this but not nearly as much as for wheels on easy slopes. The only swamping they had to do was to clear roads for the tractors the same as they had been doing for the wheels. This made condition better on the steep slopes but did not change them on the easy ground where it was possible now to haul larger loads than even with tractors and wheels - over 2000 board feet per load instead of about 1600.

Several studies were made of the damage done by tractor logging by Logging Engineers J. H. Price and John R. Berry, the first being on the Plumas in 1925. By 1927 the tractor had invaded the ground, formerly considered only fit for donkeys, and was being used by such confirmed donkey loggers as the Diamond Hatch, Pickering, Madera, Sugar Pine and Yosemite Lumber Companies. In 1928 a damage study was made of tractor logging on the Stanislaus in the Pickering tract. The result of these studies, made on all conditions of topography and forest cover, was a set of regulations for tractor logging of Forest Service land. These rules were, briefly: hire a special man - "cat boss" - to supervise tractor logging where the output is over 100,000 feet board measure per day; fell trees so that the logs can be taken out with the minimum damage to reproduction and reserve stands; lay out road for the tractors and have the tractors keep to these roads; take advantage of all openings for use as roads or turning places for tractors.

About 1927 a new development in wheel construction was tried out in Eastern Oregon, and it reached California the next year. This was the "fair lead" device, which eliminated the need for bunching entirely from wheel and tractor logging, and went a long way towards eliminating awamping also. The new type had a lead block mounted on an arch. Several hundred feet of line was carried on a drum in the rear of the tractor which was connected with drive shaft of the engine and was controlled by a leverage hand brake. The logging line passed over the fair lead block, and to it was hooked from one to four chokers. This outfit could go out into the woods with the line and chokers dragging behind it, hook onto a load of logs, pull them up to the block on the arch and take them to the landing with just the ends of the logs touching the ground. At the bottom of a steep slope it could unreel the line, climb the slope and then drag up the logs to the fair lead and go on its way.

The Red River Lumber Company took up this new idea and in 1928 experimented with it extensively. Wheels were discarded and Athey Truss wheels of the caterpillar type were substituted. The first tests showed the fair lead to be much less expensive than the hydraulic wheels, and B. O. Hughes' report of May 1, 1930 stated that the fair lead wheels delivered logs for 61 percent of the cost of hydraulic wheels and 77 percent of direct skidding. The Caterpillar, Allis Chalmers, Cletrac Companies, and others, took up the development of this new idea, and the result was an almost complete revolution of logging procedure. Within six years the industry had gone from horses and wooden wheels, the standbys of generations of loggers,



to tractors and steel. Furthermore, they had eliminated two steps in wheel logging and were invading the field formerly held exclusively by donkey engines. The new steps were to change the tractor fuel from expensive gasoline to the cheap oil of the Diesel type motor and to put the donkey engines on the shelf. Both of these were not long in coming.

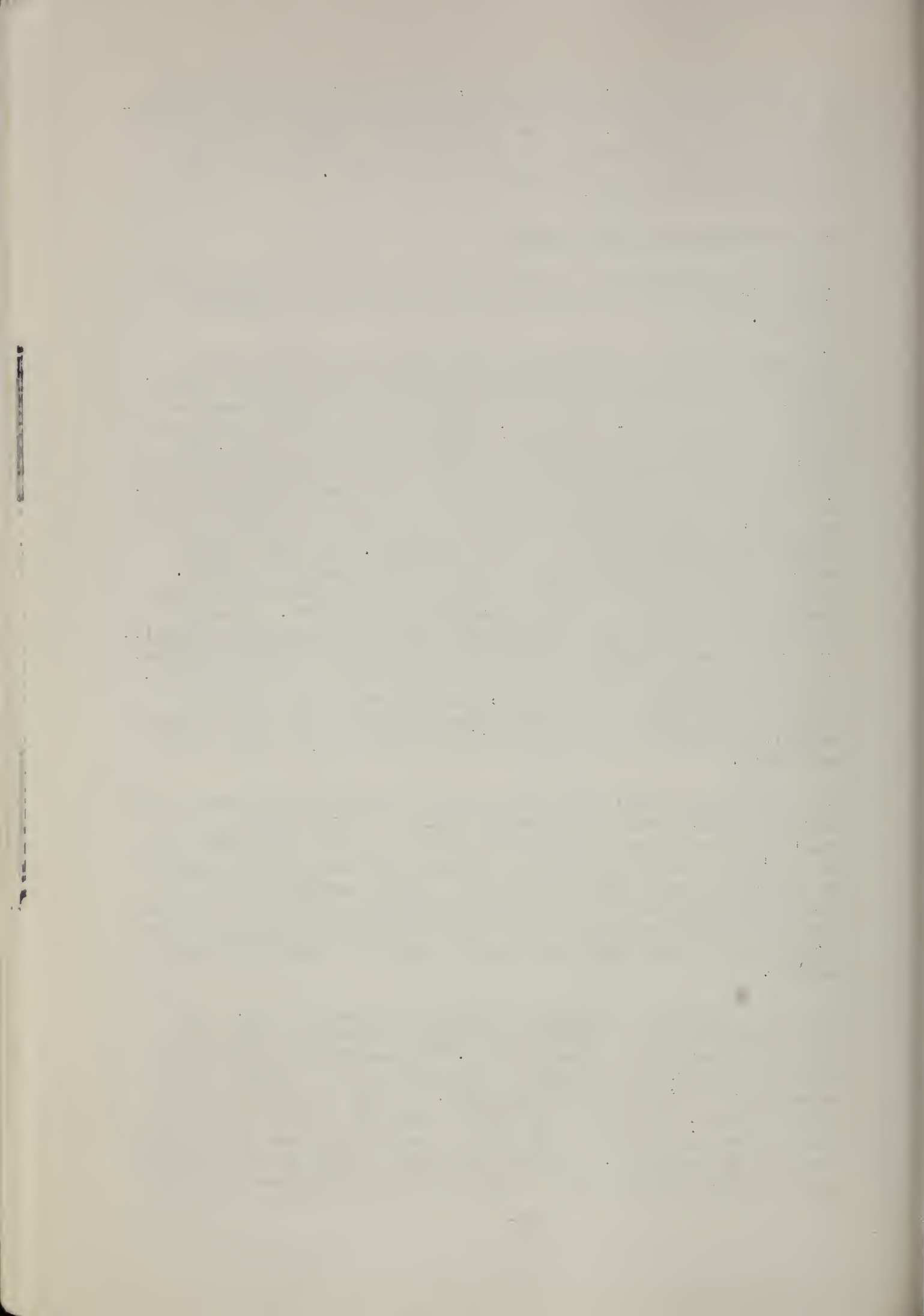
The Development of Steam Logging

It will be necessary now to trace the use of steam and electricity in the logging woods and bring it up to this point of equipment history.

The Redwood region, according to most historians, saw the first logging operations in California and perhaps on the Pacific Coast; it was also the scene of the first application of steam power to logging in the State. George H. Cornwall, editor of the *Timberman*, in the proceedings of the Pacific Logging Congress of 1925, said that the first donkey engines on the West Coast were installed near Oak Point in the territory of Washington. Professor Emanuel Fritz, in a paper on "The Redwood Region, Its History and Development", at the Pacific Logging Congress in 1936 said, "It was in 1881 that the steam donkey engine appeared in the redwoods. The first logging boilers were stationary, being bricked in like sawmill boilers. The use of the donkey engine for logging was made possible largely through the invention by John Dolbeer of the "gypsy". Later the spool was set upright and the machines came to be known as Dolbeers. ----- The redwood region is thus the birth place of donkey logging. It is also believed that wire rope was first used in the redwoods. Prior to the advent of wire rope, hemp rope was used. The late Captain Robert Dollar of shipping fame was one of the early redwood loggers, and used to tell interesting stories of the trouble hemp rope gave."

It is more than likely that the sailing profession and methods of the sea had a great deal to do with the origin of steam logging. It would be natural for a logger like Captain Dollar, whose first boat was a lumber freighter, to take a steam winch from a vessel and set it up in the woods, hemp rope and all. Such a machine (with wire cable) has been seen in use in the Stanislaus Forest, and it is certain that the first loggers must have learned how to increase power by the use of blocks and how to splice ropes and cable from some sailor.

At first the Dolbeer or "gypsy" donkey, according to J. D. Young in the proceedings of the Pacific Logging Congress in 1912, had about 700 feet of five eights cable. This was hauled out into the woods by a horse and fastened to a log by chains or "dogs". The Dolbeer had a single upright cylinder, 6 1/2 by 9 inches in front of the boiler. Soon after the Dolbeer came the machine with a cylinder each side of the boiler and two horizontal drums for the main line and the haulback. Although the Vulcan Company of San Francisco made a single cylinder yarder, the size of the cylinders grew from



8 x 10 inches to 12 x 14 and even to 14 x 14 in the redwoods, and a third drum with a straw line for line changes was added. Professor Fritz states that in 1891 the bull donkey with the double drum was invented by David Evans and began to displace the bull teams. From this time until very lately, the steam donkey was the main logging machine for all rough ground on the west Coast. The names of some of the best known makes were Tacoma, Seattle, Smith and Watson, Diamond Latch, Willamette and Humbolt.

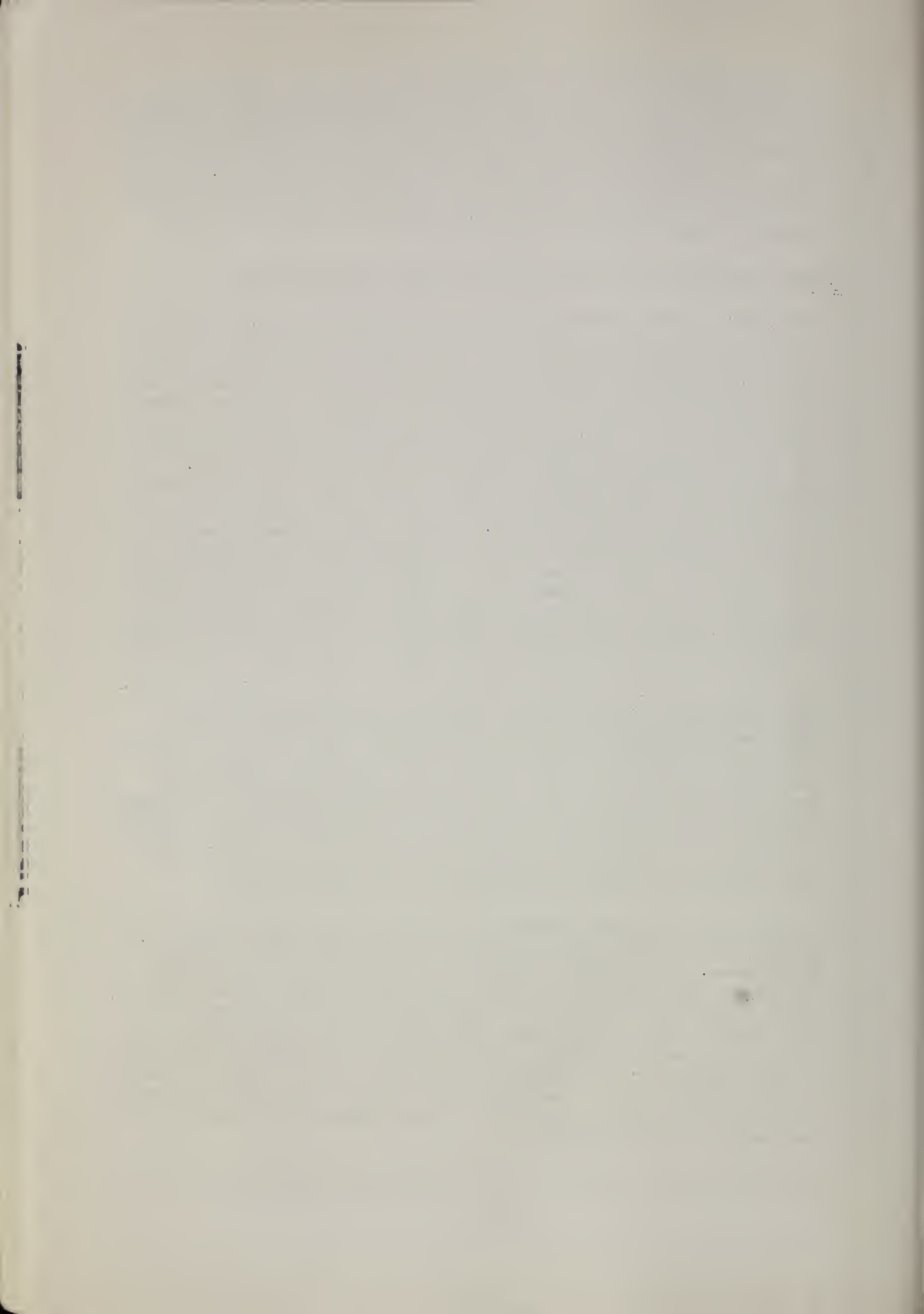
Power Logging and its Effect on Timber Sale Administration

The Forest Service entered the scene in California about the time when the Dolbeer was giving way to the regulation donkey which was at that time comparatively low in power and of slow speed. About three hundred feet a minute was average in 1907 for the main line, and twenty years later it was four times faster. A typical donkey logging layout in rough country for that period would be a main chute running up a gulch from one to three or four thousand feet. At the bottom of this chute, would be a bull donkey or roading engine and a loading engine, if the railroad was there, or perhaps the bull donkey might be at the mill on a small logging chance. Along the chute would be yarding donkeys, each placed to take advantage of the topography, to haul the logs from the stump to the chute for a distance of from 1200 to 1800 feet. Close to the yarders would be a swing donkey to take the logs from the yarder and drag them through a "frog" or switch into the chute. At each frog the logs would be collected in trains so as to give the bull donkey a worth while load to take down the chute to the mill or railroad.

There were possibilities for devastation in such a logging system but, compared to what developed later in donkey logging, there were two mitigating conditions; the donkeys were not fast nor powerful which accounted for the chute, and the chute was a guarantee that most of the logs would come out over that road exclusively and thus confine the damage. The chief strategy used by the Forest Service in later years, when dealing with powerful steam and electric donkeys on timber sale areas, was to have the logs taken out by the same layout of main roads and branches that the old 10 x 12 bull donkeys and the 8 x 10 yarders used in chute logging.

By 1913 the Willamette Company was turning out a compound 11 x 13 yarder with an extension fire box for extra power and steaming qualities. The lumbermen wanted to get rid of the cost of chute building; they wanted to do away with swing donkeys and bull donkeys; they wanted to bring in longer logs faster than they had done before. In 1906 the logs were mostly 16 feet in length, and they had to peel the largest fir and sugar pine butts, as they did in the redwoods, so the machines could handle them. So they went to the logging woods of Washington and Oregon where the heavy stands of Douglas fir, hemlock and cedar had brought about the use of heavier and faster machinery.

Two more logging methods were to come down into California from the



north, the high lead and the sky line, both of which were first being tried out in the Northwest about the same time as the electric donkey. The sky line, or over-head trolley for conveying logs, was simply a means of getting timber out of high, and sometimes inaccessible, ground. The rigging was expensive and difficult to set up so, unless there was a good stand of valuable timber, this method did not pay. As a matter of fact it was not used extensively in California for that reason. The rigging consisted of a 1 1/2 or 1 1/4 inch standing line stretched between two spar trees. The logging line passed through a block on the trolley so that the load of logs could be raised or lowered to the ground. A yarding donkey logged 32 foot or longer logs to the spar tree where they were taken by the sky line and lowered by a second donkey to the bottom spar tree. There were several ways of rigging the trolley and some companies used a double standing line and two trolleys, one going up empty as the other came down with a log. The sky line was fast, saved the wear and breakage of logs, and, so far as the Forest Service was concerned, the path of the logs on a trolley was just the same as the opening formerly cleared for a chute or main road. The Clyde Iron Works of Duluth, Minnesota made a "universal logger" which was supposed to combine ground and sky line logging and was used by the Weed Company in 1914.

High lead logging was one of the knottiest of all problems to the timber sale men of California and was just in the way of being well solved when the tractor and fair lead wheel settled it for good. Ever since they had dragged logs up to a donkey engine, they noticed that it was a great advantage if the line was clear of the ground near the donkey. With a lift at the end, the logs would ride over or around obstructions and thus save time and increase the output. Year by year the height to which the line, or "lead" was raised at the donkey increased, until in the Northwest there were spar poles 150 and 175 feet high. A layout for an ideal high lead chance on private land was to set a yarding donkey, steam orelectric, on a point or on high ground with a logging range of 270 degrees of a circle; have a high spar pole for the lead block and then haul the logs in 64 lengths out to a radius of 2000 feet. This was a far different system than the old chute-bull donkey and yarders and was about ninety per cent more destructive. Some areas of private land, where high lead logging was carried on, were a scene of savage devastation. The powerful machines had knocked down every standing tree above ten feet high and had churned the broken limbs and trunks into plowed up earth. The before and after contrast, from a stately forest to a scene of desolation, was startling.

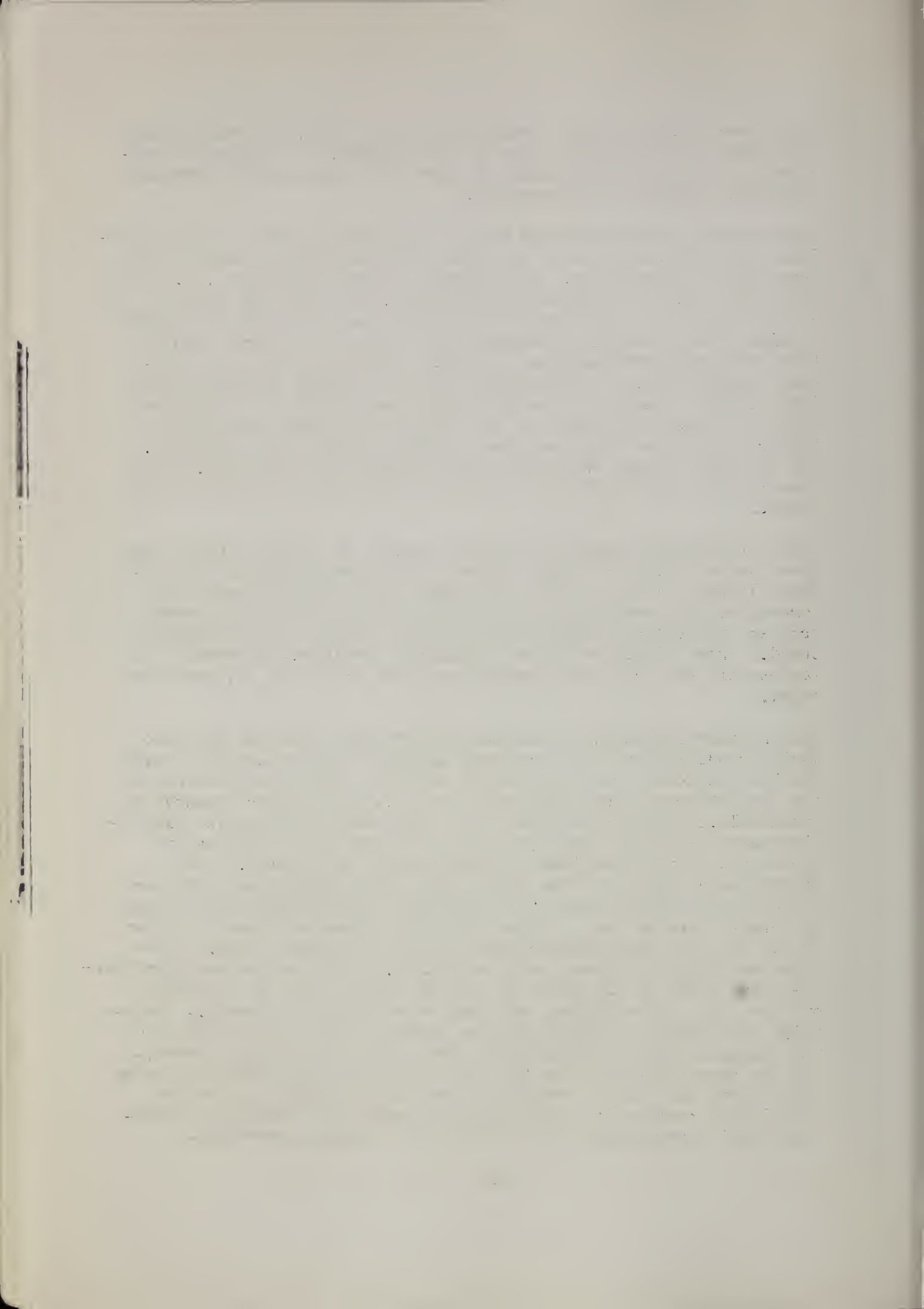
Needless to say, the Forest Service was watching the development of high lead logging. It was studied by Logging Engineers J. H. Price and John Berry. Price found that on the average for distances up to 1200 feet, the output was 11 percent greater for ground than for high lead. Berry reported that the advantages of high lead were to reduce cable costs, allow the use of smaller equipment, gives an advantage on up hill pulls, simplified the logging lay out, and he agreed with Price that there was little or no advantage at the spar

pole over modified lead. Modified lead was what the Forest Service insisted on when logging under a sale contract. It allowed the operator to raise the lead block 30 feet which was, to all practical purposes, making it a ground lead.

The modified lead was waived on the Stanislaus in 1925 in the Pickering Lumber Company sale on the plea that the company needed a high lead pole to store logs. By agreement between Lumberman W. S. Price and Bill Mayall, the woods superintendent, the line was tied down by a bull block at a safe distance from the spar pole making it ground roading from there in. Lumberman Bert Hurt on the Sierra handled the lead high speed machines by almost taking the place of a company logging boss. He practically laid out donkey settings, picking out the location of the spar pole, deciding on the roads over which the logs would come out and taking particular care that the timber was felled with the trees pointing in the right direction. He used high stumps and siwash trees instead of bull blocks. The speed of the main line was held down to 500 feet per minute on all sales.

One of the early students of donkey logging on Forest Service land was the late Ray Orr of the Plumas, who pioneered many of the rules on logging with donkeys. The goal toward which all sale men worked was the reduction of the number of log trails which meant a greater survival of reproduction and less damage to the remaining stand. They tried, so far as conditions permitted, to repeat the layouts of the old chute logging days when many logs followed one road.

The greatest obstacles to leaving the cut-over areas in good producing condition was the increased speed of the machines, and some of the speediest were the electric donkeys. These had been in use in the Northwest since 1910 when the C. A. Smith Lumber Company of Marshfield, Oregon tried them out. They were introduced in California about 1923 when they were used by the Sugar Pine Company of Fresno and by the Hutchinson Lumber Company of Oroville. John Berry made a study of them on the Sugar Pine private land and reported that they had need of considerable supervision when logging on Forest Service land. Aside from their speed and power they reduced the fire risk considerably compared to steam donkeys. When used according to timber sale regulations, they were no more destructive than steam as was shown by a study made in 1930 on the Sierra by the late Walter Jotter, and they were cheaper to operate. Naturally they could only be used where electric power was available to the logging areas, which limited their usefulness to some extent. It was about the time when the end of the steam and electric donkey as a power unit in the woods could be seen clearly, for the gas and Diesel tractor with the fairlead wheels were even then displacing them in many parts of the California logging operations.



VII

FOREST WORKING AND MANAGEMENT PLANS

A plan, "an arrangement of means or steps for the attainment of some object-, a mode of action," is indispensable to the practice of forestry. No business, which must look into the future for fifty or one hundred and fifty years, can be considered organized until it has evolved a method by which to operate. If we are going to manage land according to forestry principles, it is axiomatic that there be some plan of action.

Plans for forest management can be the most elaborate and technical expressions of the forester's art, on paper as they are in Europe, or they can be, as they were prior to 1905, just a simple statement of business procedure by which the Interior Department could sell timber on the forest reserves. According to the instructions in the Forest Reserve Manual of 1902, "Forest reserves have two chief functions: continued production of timber and regulation of the water supply ----- all questions concerning their management must be decided with regard to future effect as well as immediate result. The first question to arise when the removal of any timber is discussed is whether or not it can be spared, and the foremost point to be studied is the reproduction of the forest under various conditions." The manual said that all land bearing commercial timber within the reserves should be surveyed into blocks and districts and mapped, estimated and described in a systematic manner. This was to enable forest officers to conduct timber sales "with certainty and dispatch."

The idea of the continuance of the forest is brought out and this, with the inventory of the timber resources and the division of the forest area into blocks or working circles as they are called, is the first step in a forest management plan. In those days it was not called by that name, but it was that in effect according to the definition given twenty years later by District Four of the Forest Service when it said, "By a management plan we mean the systematic method of doing those things which are to be done on a forest."

There is nothing in the files of the California Region of the Forest Service about forest management plans between 1905 and 1911. The Use Books of 1907 and 1908 do not mention them but there was a special section of the Forest Service Manual of 1911 about plans and planning. There was to be a complete plan for each National Forest to cover timber management and all other classes of forest business. Strange to say, there was little mention made of fire protection, yet within ten years this activity had intensive plans while the other plans were neglected. The complete plan was to consist of three sections, preliminary, working, and annual. The preliminary plan was to be made by the supervisors, - in fact the supervisors were held responsible for all planning, - and was to consist of a compilation of all available data then on hand about the resources of the forests.

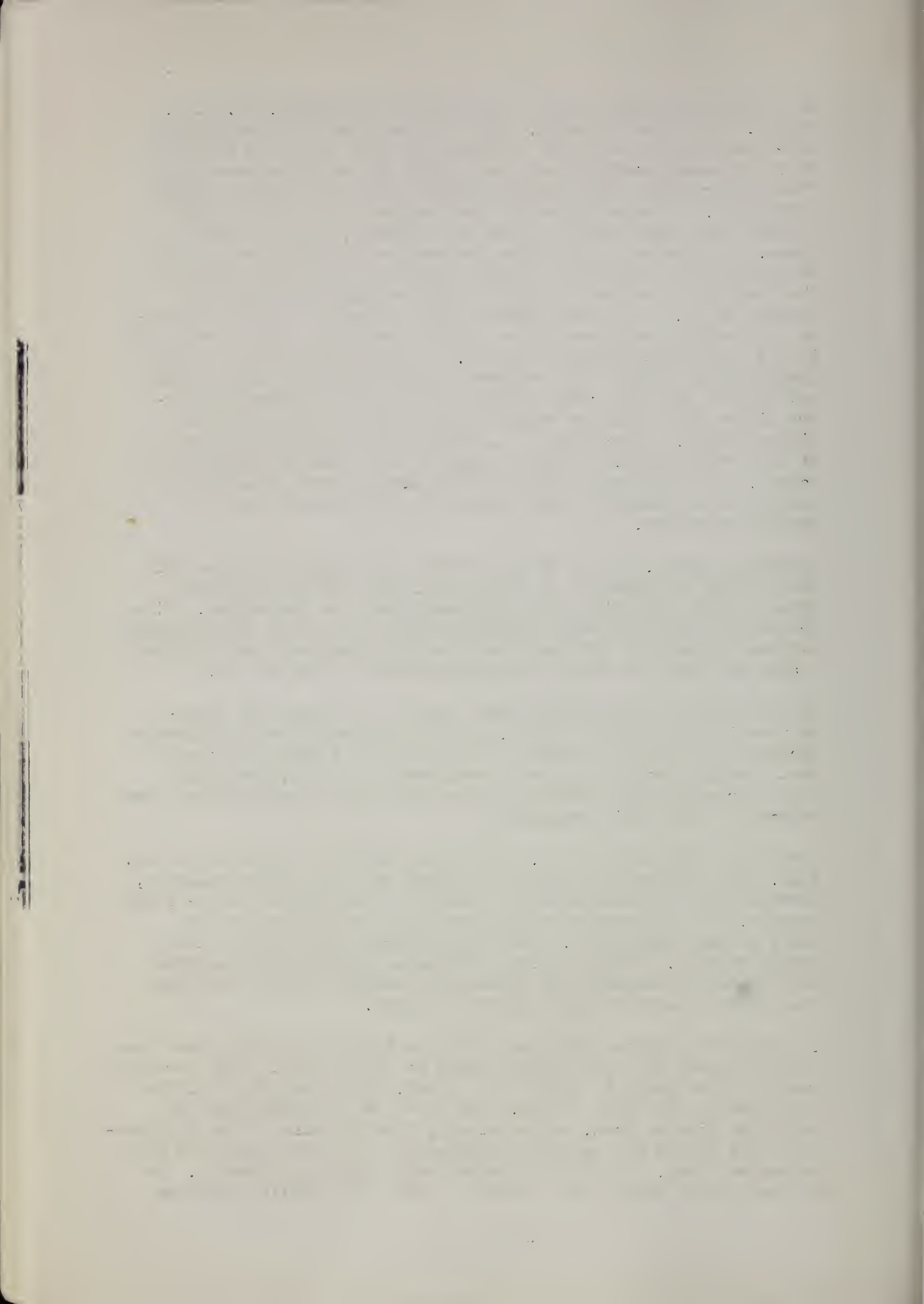
In a letter of August 1911 to the District Foresters, Mr. H. S. Graves, then Chief Forester, said that he hoped this preliminary work would start the forest officers thinking and would result in efficient administration and that within two or three years the "best supervisors will develop splendid plans for general administration". He also wanted to show Congress that the National Forests were being handled under far reaching, well considered plans. Mr. Graves at this time proposed an outline showing what information was necessary for each section of the plan and told the District Foresters to look it over and tell him what they thought of it. That same summer, 1911, Assistant District Forester Roy Headley went over to the Mono and made the first forest plan in the California National Forests. It was a good place to begin planning operations. The business of the forest was well defined and without too many complications in the way of estimating future timber sale business because of the scarcity of commercial timber stands. Supervisor W. L. Maule states that, to the best of his recollection, no use was made of this plan in managing the Forest. The next year, 1912, Headley made a forest plan for the Inyo which is similar to the Mono as to the kind and class of natural resources.

Strangely enough, in all these outlines, and also in all the talk about plans and planning in those days, very little weight was given to fire protection and practically none to recreation. Fire protection plans had been inaugurated by Coert duBois in California National Forests in 1910 and these, with recreation, were destined within ten years to become the most important plans of all.

In the spring of 1912 Swift Berry, then in the branch of Silviculture in the District Office, wrote a memorandum for the District Forester in which he divided all the California National Forests into working circles for timber management. But this probably only represented the District Office ideas for the supervisors were supposed to use their judgement.

The outline discussed by Mr. Graves was issued to the field in May, 1912. The instructions covered 17 pages and the outline analysed, inventoried, and appendixed all classes of business on the national forests. The information called for was all-inclusive for the past, present and future. The silvicultural sections went into growth studies, cutting cycles, rotations, silvicultural systems and all the refinements and treatments accorded forests which had been under management for hundreds of years.

The District Forester took two months to think all of this over before he passed the instructions along to supervisors. They were the ones who were going to build these plans, with, perhaps, a little help from the District Office. And it can be inferred from the length of time he took, and especially from the tone of his instruction, that he was not entirely in sympathy with such a detailed and intensive study. In fact his letter seems almost apologetic. He started out by saying that sooner or later the available date on



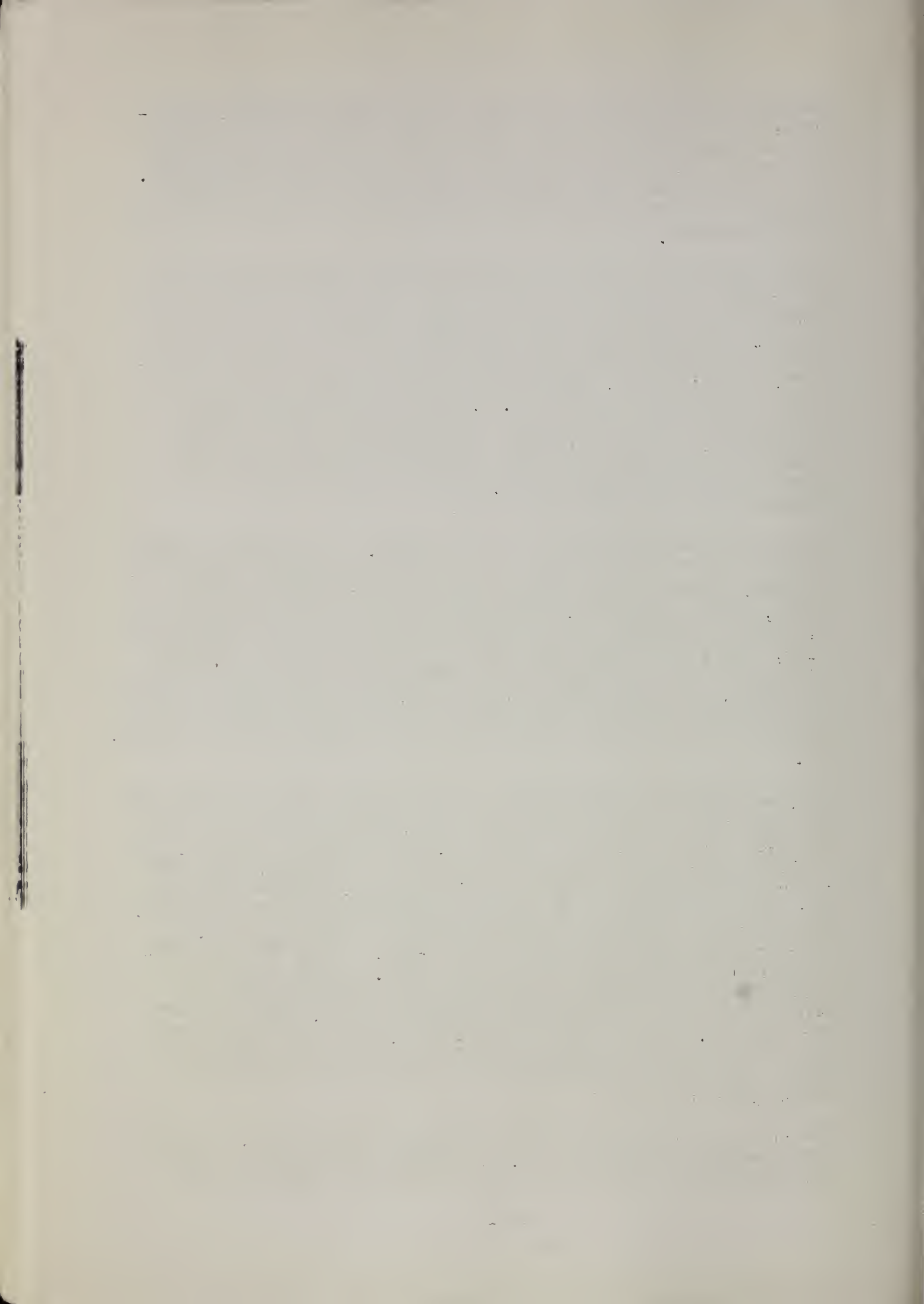
resources and the plans and ideas that have been developed regarding their management must be collected and arranged in the form of a preliminary forest plan for each national forest. He told them to think it over, take their time, and then give their best ideas. But he did not send any outline at that time for them to follow; instead he told them to get their constructive imaginations working on this problem.

Maybe the Forester noted this rather dubious attitude toward his pet project for he sent out three of the most expert silvicultural technicians available to make a sample working plan for the Plumas Forest. All during the summer of 1912, Barrington Moore, of the Branch of Silvics, which had charge of plans in the Forester's office, collected data. Raphael Zon, then in charge of the office, came out also, and Professor H. H. Chapman of the Yale Forest School showed them how to make a yield table for Plumas timber. In February, 1913 this document, The Forest Plan for the Plumas Forest, was completed - 34 pages, mostly of tabulated material, photostated down to letter size. Chapman study of yield on the Plumas covers 100 typewritten pages.

There was no introduction to Moore's report. It was just a compilation of boiled down data and tables on climate, topography, soils, geology, transportation, population, forest industries, forest types, timber operations, markets and on down to the management of the timber resources. He divided the Forest into four working circles, which, by the way, were never referred to later. Chapman's study, which was the appendix, had some discussions of yield and increment, and sample plots were established for the study of growth. This document marked the high tide, in California at least, of the intensive working plans modeled after the European systems of forestry.

In 1914 Supervisor Norman Sloane of the Monterey made a working plan for that forest only to prove that the Monterey did not rate as a national forest at all but only as a ranger district because of its limited resources in Forest Service control. Dwight C. Birch made a working plan for the Sierra in 1915 and W. H. Gallaher made one for part of the Tahoe. But plans and planning were in a recession. They were more or less a technical gesture to give the files, as Shirley Allen expressed "a scientific aroma." They were not needed as instruments to work with at that time. It was a period of building the foundations of national forest management such as ranger stations, roads, pastures, telephone lines, guard stations and lookouts. It was time of strenuous physical construction and not of the leisurely study so necessary for technical accomplishment. The forest management plans of that day were "born about thirty years too soon."

The files of the District Office contain a letter from R. Y. Stuart, then Assistant Forester, to T. D. Woodbury saying that Mr. Clapp was preparing an outline form to be followed in preparing forest



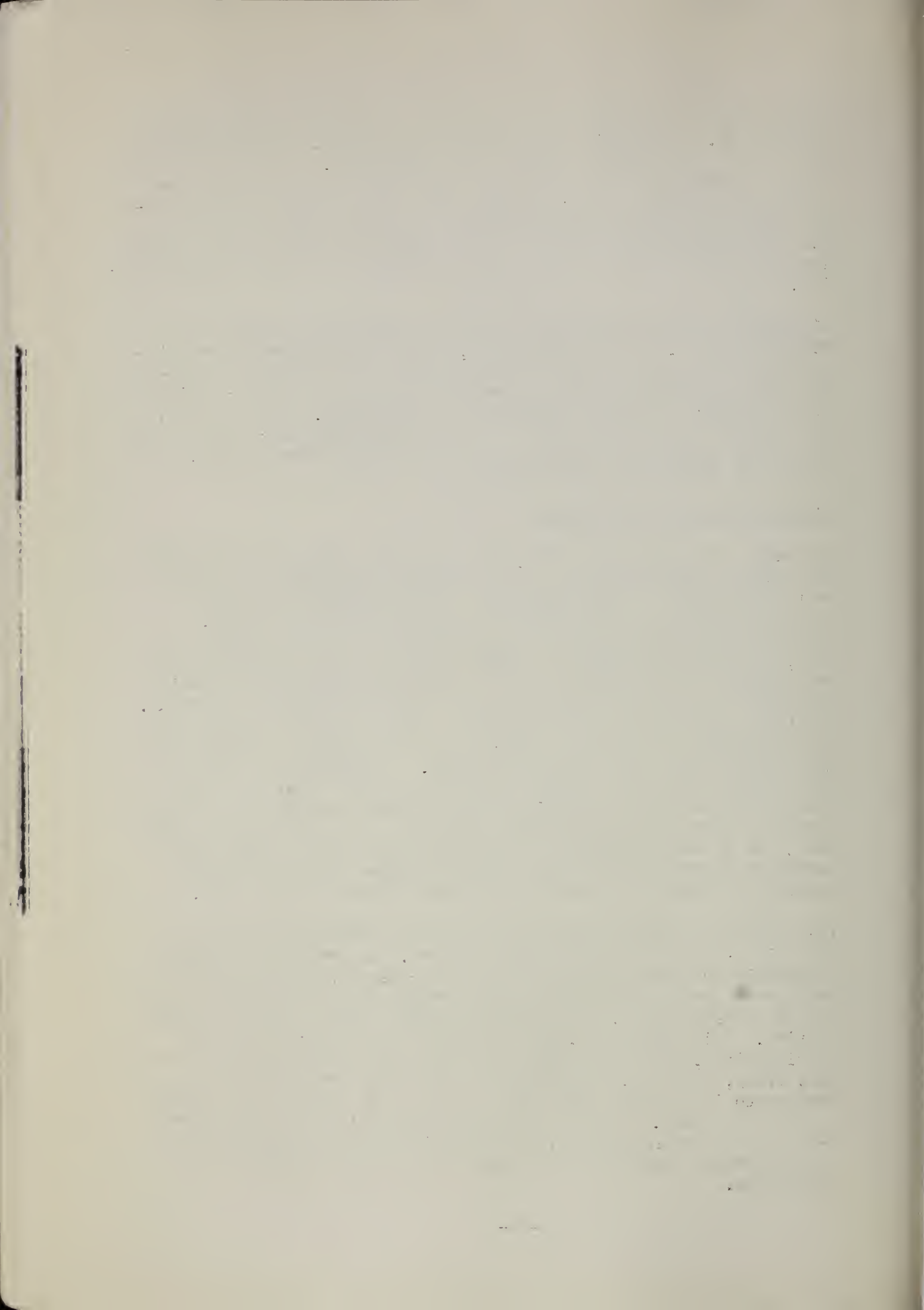
working plans and asking if anyone in the California Region had any suggestions. This letter was written in November, 1913 and was the last one on this subject for the next five years. This was the end of one chapter in forest planning. From then on the idea of compiling an economic and sociological inventory of each national forest was to be dropped and succeeded by a natural growth of plans for each activity and resource of the forests in the order of their importance and as they became really necessary for forest administration.

Fire protection plans started in 1910 and gathered momentum each succeeding year. Timber estimating, timber reconnaissance and timber inventory - all in effect the ground work of a forest management plan - commenced about the same time and is a chapter in itself of the history of forest management in California. At the time it was started the idea was more to secure data needed for placing timber on the market and in connection with pending timber sales. But it was the ground work nevertheless.

Revival of Plans and Planning

The topic of working plans was, for the first time, to be presented for serious consideration to the California supervisors at their meeting in Davis of February, 1919. It is possible to obtain a good prospective of this subject in the letter written by Mr. Woodbury in November, 1918. In discussing this coming meeting he says, "The District Office has never taken the lead in working plan work simply for the reason that our timber resources are not being utilized to a degree which has pointed out the necessity for plans. In other words, we have not believed in the past that working plans were necessary, because one could not see the need of them and did not believe they would work if prepared." He went on to say that the policy of national forest management in California was very simple; it consisted in selling mature timber wherever the operator wants it unless some reasons were known why the sale should not be made. So he was beginning to think that some sort of plans were needed on forests with a heavy stand of timber where there were prospects of heavy utilization and demand within a short time.

This letter was sent to all of the District Foresters - seven at that time - and of course to the Forester. It provoked a flood of interesting discussion from all the other regions where forest management plans had evidently gone through the same evolution as in the California Region. Some parts of these letters are well worth quoting. Said Franklin W. Reed of District 7, "In talking about working plans, as I understand it, you are not thinking of the great big, bulky, unwieldy, unused things which the Forest Service was interested in some few years ago and for which a sample was worked up for the Plumas. You are simply interested in the silvicultural part of the working plan or, to put it in other words, the working out of cutting budgets and of plans for systematic timber sale regulation.



District Forester Smith Riley of District 2 wrote that they had used the plans prepared in 1912 and 1913 and would revise them when accurate data was available. The Black Hills division of that district was evidently where most of the timber management plans were needed at that time. L. F. Kneipp, District Forester of District 4, said that, while the experience of the district had been somewhat disappointing, he did not believe that condemned the working plan theory but was strongly of the opinion that a basic working plan, dealing with fundamentals, was absolutely necessary for good forest administration. He believed that, where the anticipated sales of timber amount to less than 1 percent of the annual increment, the preparation of a detailed working plan is more an exercise of the imagination than a beneficial administrative activity.

Thornton Langer of District 6 said that he feared the administrative officers were forgetting, in the routine of handling current business, the big purpose for which the national forests were created; that we were working somewhat blindly, or without a far-seeing foresight toward the ultimate objective; that we had no clear cut purpose in view in shaping the administration of our timber resources toward sustained yield, and sustained local industries and communities.

Professor H. H. Chapman, then in charge of the Branch of Silviculture in District 3, said that working plans for the management of the timber resources had lagged behind plans for range management, fire protection and improvement development.

Barrington Moore, the working plan expert, summed up the general experience of the Forest Service by saying that, before development of a plan can begin, there must be a demand for the resource or for the performance of the work with which the plan is to deal. Plans to be workable must develop gradually and, while there were many plans, few were workable. He believed that a lot of time had been lost because there had been a belief that a working plan referred only to the regulation of cut.

Out of all this Woodbury boiled down the essence and added his ideas to make up a new program for the California District. He presented the subject at the Davis meeting in February, 1919 and in March called in two members of the Field Advisory Committee, and told them to write their recommendations for forest management plans. In April, circular S-121 told the supervisors all about silvicultural projects in the plans for that year. He gave them a year to get out a timber record showing the timber cut and left on sale areas over ten acres in extent; plans for timber survey work covering a five year period; recommend working circles to insure a supply of timber and fuel for small communities; furnish data on private lumbering operations and timber holdings to enable the District Forester to negotiate timber sales and land exchanges and show what Forest Service stumpage was tributary to each operation.

The California District of the Forest Service evidently started the revival of plans. Headley's letter was dated November 25, 1918; on December 6, Assistant Forester E. E. Carter issued a statement from the Forester's office asking for the status of plans in all the districts, what units needed plans, and for any discussion about the plans. It can be reasonably inferred that Headley's letter reminded him that now, with the country's resumption of "normalcy" after the World War, it was time for the Service to be prepared. One part of his letter is significant: "More and more, however, the wisdom of using a sociological and economic basis for the working circle has come to the fore". When District Forester Coert duBois returned from France, he expanded this idea into what was, so far as is known, the first economic study using the land and resources of the national forests of California as a base.

In France duBois had seen a stable population whose chief industry was agriculture. It was well supplied with wood and wood products which were grown at home, so to speak, and handy to their needs. He compared California, particularly the San Joaquin and Sacramento Valleys with their population of farmers and ranchers, to France.

He developed the theory that the rural, and also the urban population of the State, should be supplied with wood products from the national forests of California. The question of where the supply of lumber is coming from for the agricultural population of the State fifty years from then was a matter of grave concern. He asked: how much is this population going to be; where is it going to live; what will it need of forest products and where will it get its supply. In effect he was making a forest management plan for the whole state and going at it from the outside in instead of from the inside out. Instead of taking the forest areas and saying that so much timber could be cut each year and how to take care of the forest, he was going out to see who was going to want this timber, how much would they want now and in the future, and then make his plans on how to manage the forest lands to supply this demand. It was the same idea of sustained local communities by sustained yield and the sociological aspect, mentioned by Munger and Carter, which was prophetic of the policy of the Forest Service. Like the original trials at working plans in 1912 and 1913, DuBois' economic study was too far in advance of the general development of the Forest Service to be successful. It was a special study, a very large one, which could not be farmed out to the supervisors. He had barely started on it before he resigned in October, 1919, and after he left no serious work was done with it until after the California Forest Experiment Station was organized in 1926. Of all the forest plans in California, that was the most ambitious.

Modern Forest Plans

It was W. B. Greeley, as usual, who summed things up in January, 1920 and started the Service on what, up to now, is the modern plan methods. He said that the steps in a management plan were: 1 - preliminary classification of timber areas on each forest and an outline of how the timber business should be handled; 2 - assemblage

of data and information, useful in preparing management plans, when necessary; 3 - preparation of management plans for working circles when administrative situation requires them. The first thing to do was to complete the timber surveys, so we would have an inventory of the timber and information on the forest resources. From then on the Forest Service was going to direct the sale of timber, according to the order of urgency of sales from silvicultural and other standpoints, rather than by the order of sale applications from purchasers. To facilitate this policy the supervisors were given wide latitude in rejecting sale applications. There was going to be some plan made for the disposal of Forest Service timber resources.

Greeley's comments resulted in a revision of the management plan section of the Manual. But it did not result in any stimulation of plans on the forests. In spite of the discussion at the Davis meeting in February, 1919, and Woodbury's efforts to clarify the atmosphere, the California supervisors, with few exceptions, were still decidedly plan-shy. It remained for a Washington Office Inspector to finally get results.

In the summer of 1922, I. F. Eldredge, Inspector in the Branch of Forest Management, was specializing on plans and visited the Plumas. He wrote that Supervisor D. N. Rogers had done some excellent work in dividing the forest into working circles, studying the problems in the circles, and drawing up a policy statement for each circle. While these policy statements were really more than that, they were not true management plans, and he recommended that one be made for the Meadow Valley area which he considered as ideal as an opportunity for this purpose.

In a memorandum to the Forester on June 11, Eldredge gave a record of his general observations concerning management plan work in the California district, which may also be presumed to apply to other regions of the Forest Service at that time. He believed that there never had been a clear and definite conception of what constitutes a forest management plan for American forestry. There had always been the remembrance from forest school days of the complicated and voluminous European working plans acting as a bogey to scare off prospective planners. Consequently, the forest supervisors were inclined to think the job an impossible one. He recalls the many plans worked out along conventional lines about 1912, and states that it has been almost the universal experience that these plans were never followed for any length of time. He wanted to assure the average supervisor that a management plan can be made which can be followed which would be a business plan - a simple, workable, common sense program for the disposal of the resources. Especially he wanted to prove that such a plan will not be simply an addition to the files, but something that will be used because it will deal with something the Service is taking action in.

Eldredge warned of the mistake in going on selling timber to whoever wants it, and when and where they want it, without knowing what we are doing or where we were going. He was alarmed by the

number of sales involving large amounts of timber made without any relation to management objectives. "It is far better to make an avowedly tentative plan of management, based on extensive rather than intensive surveys and subject to revision at intervals, than to continue to cut timber on a large scale or to obligate its cutting in the future without any plan."

The Plumas was about ready to make management plans, and Eldredge furnished the impetus and also the new philosophy of forest planning. The result was the plan for the Meadow Valley Working Circle made by the late Supervisor, John S. Everitt, who was then Forest Assistant on that Forest. It seems only fitting that the same forest, which had the first non-workable plan, was to have the first workable one in the California district. Everitt went to work in the summer of 1922, and in March 1923 the plan was approved by the Forester's office. In 1928 the bulletin "Management Plans with special reference to the National Forests", Miscellaneous publication No. 11 of the Department of Agriculture, by Eldredge was published. This still is the authority on management plans for timbered areas. The text included three plans as examples, and Everitt's is one of them.

After 1923 management plans in the California National Forests went forward steadily. In October 1922 Mr. Woodbury reported to the Forester that management plans had been prepared and approved for the following working circles: Lincoln Highway, Eldorado; Mono Lake-Owens Valley, Inyo; Eastern Lassen, Lassen; Pit River-Goose Lake Valley, Modoc; and Meadow Valley, Plumas. Policy statements for all the forests had been approved and some revisions were pending. Plans were also prepared, but action was pending, on the Rush Creek area on the Plumas and Kings River on the Sierra. Five forests had plans in course of preparation. This is a vastly different state of affairs than was reported by Woodbury in December, 1918 when he told the Forester there had been six plans made from 1911 to 1918 in California, and that none of them were used; and only one of them, the Plumas plan by Barrington Moore, treated of regulation and yield. Between 1922 and 1925 more had been accomplished than the first eight year period and all of it was practical, valuable, and in use.

The chief reason for this difference was the stage of administrative development of the national forests. The pioneering work was about finished; the initial construction work was complete, and the supervisors and their staffs were ready and willing to take up the technical problems connected with forest management. The District Forester and his office was better prepared to help the supervisors. The Feather River Experiment Station and the Branch of Research under the direction of J. A. Mitchell, S. B. Show, Duncan Dunning, and Ed. Munns had laid the foundation of experimental work in growth studies and other silvicultural problems. Research had furnished data, indicating the length of time it takes trees of the various species to grow from one diameter class to another, as a basis for calculating the future cut. Rotations were based on the length of time necessary to grow

saw timber of from 24 to 28 inches in diameter. The yield during the first cutting cycle was calculated by spreading the stand to be cut, under the prevailing marking practice, over the cutting cycle. Rough predictions for the second cut were made by a study of dominant and codominant trees on cut over areas.

The progress made in that line of work was indicated by Mr. Woodbury in an article of December, 1928 which reviewed the planning activities in California since 1918. He said that there was then 619,000 acres were under regulation, containing over ten billion board feet or a little over ten percent of the estimated merchantable timber in the California National Forests. There were then management plans for nine working circles on six national forests. Only one of these, the Meadow Valley plan, included private, as well as Government land, where the private land was to be handled in the same way as the Federal areas to insure a comparable second cut. For many years the Spanish Peak Lumber Company, whose lands were included in the Meadow Valley plan, was the only commercial lumber operator who was practicing sustained yield according to Forest Service regulation.

This problem of regulating only the Forest Service areas without the private lands became important just as soon as the Service began to make real management plans. Woodbury said in his article of December, 1926: "In connection with the preparation of all plans involving considerable acreages of private lands under the control of operators concerned, silvicultural and management prescriptions have been outlined for the alienated land. These programs have been taken up in conference with operators with varying results. Usually fire protective suggestions are readily accepted and well executed. Suggestions regarding limitation of cut on private lands, however, particularly when such action would necessitate a reduction below the present annual cut, are regarded with apprehension and are not agreed to except when the future welfare of the concern in question is dependent upon securing the allowable cut of government timber. Even then the agreement is reluctant and its execution in the woods leaves much to be desired."

There are very few areas in very few national forests of California where the Forest Service has control of enough timber land to say definitely how the forests will be cut for the next one hundred years. The large amounts of private land mingled with government land in the national forests of this state in the pine region indicated that, unless owners of timberland would adapt this system of regulation as outlined in the management plans, the field for planning would be restricted. This brought to a head one of the most important problems of forestry in the United States, cooperation with private owners, which is only now beginning to be solved and is a chapter of forestry history in itself. Part of the management plan was to sustain local industries, but it was going to be difficult in some cases to keep alive lumbering communities and logging operations which had no desire to perpetuate themselves,

- that is, the logging operations were nearly all managed under the pioneer lumbermen's policy of "cut out and get out".

The exceptions to this policy in California were the Spanish Peak Lumber Company, whose lands were included in the Meadow Valley Working Circle on the Plumas, and the Fruit Growers Supply Company on the Lassen, whose holdings were in the Eastern Lassen Working Circle. These two organizations are dependent on Government timber for about fifty per cent of the forest resources necessary to make their operations permanent. The Diamond Latch Company, although it has bought stumpage from the Forest Service, claims to have sufficient timber land of its own to enable it to maintain a perpetual cut, taking, of course, what Forest Service stumpage is mingled in its holdings.

These three concerns represent different types of lumbering organizations, and all adapted sustained yield for somewhat different reasons. The Spanish Peak Company is the ordinary lumber outfit formed by the capital of one or more stock holders who engage in commercial lumbering. This company agreed of its own volition to leave on its private lands the trees of the smaller diameters, to protect the stand left and the reproduction from logging damage as far as practical, to clean the ground of debris left after logging and to practice care with fire. It has carried out these principles with integrity and success.

The Fruit Growers Supply Company is a subsidiary of the California Fruit Growers Association, composed of southern California citrus farmers, mainly a cooperative marketing organization. High prices of lumber during the World War induced several fruit growing associations in the state to branch out in the logging business in order to supply themselves with box shooks at reasonable prices. The theory was that their sawmills would supply the members with boxes at cost, and they would sell the upper grades in the general market at a nice profit. The Fruit Growers had already established a plant at Hilt on the Oregon border; now they proposed to go into the game in a big way by purchasing a billion feet of timber in the eastern Lassen country. They wanted another billion feet to make a seven million dollar investment at Susanville worth while. First the board of Directors passed a resolution endorsing forestry, sustained yield, and conservation in general. Then they went to the District Forester and, without committing the association to any specific program of forestry practice, asked him to sell timber on a long term contract, giving the general impression that the Fruit Growers were as conservation minded as Gifford Pinchot himself. The District officers were only too glad to find anyone who even alleged a constructive interest in forest conservation as an aid to their management plans. A. E. Weislander was sent in immediately to make a management plan of the Eastern Lassen Working Circle; the sale was consummated, and the first cutting commenced in the fall of 1920.

It began to be apparent in the early part of 1921, that there was

something to be desired in the forestry performance of the company on their own land. They were cutting all trees down to a twelve inch diameter and were leaving about five percent of the original stand, instead of twenty or twenty five, on the adjoining and intermingled Forest Service areas. They were taking no precautions to protect the small trees and reproduction, and no attempt was being made towards disposing of the brush and debris from logging. Although they had a man hired as forester, he was on work connected with logging and had no forestry duties, except fire protection. Since the management plan of this working circle was based on the supposition that the company would leave timber enough on their land to maintain continuous production, or at least leave the cut-over lands in producing condition, the whole working plan seemed endangered. District Forester Redington and Supervisor Dunston had a conference that summer with Director F. B. Hutchins and Superintendent S. M. Bump. Redington insisted on brush disposal at the very least, and the company left all trees eighteen inches and under as the nucleus for a future cut. Later on conditions of cutting were adjusted to make possible the success of the working plan.

The Diamond Match Company is a corporation with branches and headquarters in the East. It finally came to planned production and sustained yield after two decades of backing and filling. About 1913 the Eastern office decided that the Diamond Match was going to practice forestry, so they hired F. L. Olmsted, a former district forester for California, and told him to instruct the loggers how to get the timber out without devastating the land. The local manager was out of sympathy with this idea, because it raised the cost of logging, and his attitude affected the woods superintendent and all of the woods crew. The result was that Olmsted could not accomplish anything, and the project was a failure. After this episode the Diamond Match apparently set out to show the forestry profession how little it thought of conservation, for some of its cut over lands of that period are models of devastation. This was unfortunate for the sake of conservation, as the manager of the company at this time was a forester by education, and his attitude seemed to denote a lack of faith in forest management. However, about 1930 the Diamond Match turned its logging methods completely around, and is at the present time the foremost exponent of sustained yield among the timber operators. The same manager, Mr. R. L. Colgan, is responsible for this transformation.

Another forester, Swift Berry, is manager of the California-Michigan Lumber Company, and he has planned the operations of his company along sustained yield practices so far as economic circumstances will allow. And that consideration "economics", is the real governing factor in forest management plans for both Forest Service and commercial timber lands. As long ago as 1919 Thornton Linger said that, one of the chief obstacles to putting into practice a positive policy of forest regulation, is that most of the timber inside and outside the national forest was not

"ripe economically". By that he meant the difference between the value of the raw and manufactured product was so low that the operator had to have an annual cut that was "out of all proportion to the amount of timber logically tributary to each operation and incompatible with ideal regulation of yield."

VIII

TIMBER RECONNAISSANCE AND TIMBER SURVEYS

Perhaps there is nothing in the history of the Forest Service which better illustrates the impatience of the young Forest officers to start practicing forestry on the old forest reserves, and their optimism of inexperience, than the development of timber reconnaissance and timber surveys. Actually the service should have known quite a bit about the job of cruising timber. The Bureau of Forestry had made lots of "working plans" for large lumber companies between the years of 1900 and 1905. The four man crews, consisting of a compassman with a chain tied to his belt, a tallyman and two boys with large calipers, had covered thousands of acres in the eastern and southern states. So there does not seem to be any excuse for the order from Washington of July, 1907, which asked all forest supervisors to make an estimate of the timber stands on their forests by species, and have their reports in by the end of the year.

Had there been technical foresters in charge of the reserves at that time, the Washington office would have had a few protests. But the supervisors of that day were plain, practical men who did the best they could with what they had and were used to obeying orders from headquarters. So most of them made an estimate - just how they did it we will never know -, but the results were so pleasing to the Forester that in March, 1908 he ordered a revised estimate to be made for the following year when "more attention and time could be given". All they wanted was the total amount of all sawlogs and a separate estimate of merchantable dead and down timber for each Forest; also the live and dead cordwood separately; also tables showing estimates by all species which comprised more than 3 percent of the stand; if the forest was in more than one state, the estimate should separate the stumpage by states, and also, as a sort of afterthought, the timber should be estimated by watersheds or other natural divisions.

If a modern supervisor should be told to accomplish all that, he would ask for about 40 men and \$25,000. But the pioneers were not to have one additional man nor an extra dollar. They were told that each district ranger, with the assistance of the supervisor, should make, -"a very accurate estimate of the timber on his territory.....If not already experienced, please see that your rangers are instructed in timber estimating by yourself or some other forest officer competent to do so. The rangers should be taught to estimate either by the strip surveys or by sample acres or both.....The time which you can spare from your regular duties, and the rangers' need of assistance, will, to a great extent, determine the attention you should give the field work." He ends up with, "I need not emphasize the importance of making

as accurate an estimate as possible, since you realize that it is basic to all farsighted management of the timber resources on your Forest.

That little stint was to be done by May, 1909, about 14 months off. In April the Washington office sent out an outline for a "preliminary reconnaissance report", which amounted to a respectable working plan, and followed it up immediately with an outline for "Working Plans-Reconnaissance" which consisted of six parts and an appendix. This project would have taken the present force of the California Forest and Range Experiment Station five years to complete for the forests of this Region.

The idea had expanded from a comparatively simple timber estimate into complex working plans which were to culminate later in the Forester's super outline for management plans of 1912.

In the meantime, while all this high pressure planning was effervescing in Washington, the Forests and then the District Office began to get their feet under them in this timber estimating game and find out just where they stood. Louis Margolin told District Forester F. E. Olmsted in April, 1909 that there was not a Forest Service man in the California district who was available to estimate timber by the ocular method. If we were to estimate timber by valuation surveys, we would need volume tables, and there weren't any that were any good for California. If we had to make working plans, we would need volume and growth tables, and there were no growth tables. In other words, instead of starting out in high as was expected by the powers in Washington, we were going to have to do a lot of preliminary work before we even were capable of starting on the job of timber reconnaissance and working plans. We had no timber survey tools to work with and no men who knew how to use them.

Beginning in the summer of 1909 on the Standard sale area on the Stanislaus Forest, three forest students, one of them Shirley Allen, started gathering measurement data for volume and growth tables. A similar party gathered figures on California red fir on the Truckee Lumber Company sale on the Tahoe. This practice was to continue for fifteen years wherever any sale area supplied species needed for these timber management tables. When this work commenced there were no figures for California Douglas fir, red fir, incense cedar and lodgepole pine. A. W. Cooper, the first research man in the District Office, had made some volume tables for sugar and ponderosa pine in 1905, but they were seriously defective because of lack of sufficient measurements on which to base the tables. Half of the ponderosa pine data came from Montana, and, of the 700 trees on which the sugar pine table was based, 416 of them were under 22 inches diameter and were practically worthless for volume table measurements.

It was proposed to do some timber estimating in the Cow Creek

Elock on the Stanislaus in 1909 and make a working plan. But there was not money enough for that and the volume table project, so they let the cruising go and sent Hargolin to the Trinity to look over an area that seemed destined for a timber sale.

In April, 1910 District Forester Olmsted sent out an outline for Reconnaissance Working Plans which were the first instructions on cruising to originate in the District. It was stated that what was wanted was an "inventory of our stock in trade - what timber we have, where it is situated, how soon it should be disposed of and at what price, and what method of management will bring about an improved condition of the various stands of timber".

As to the actual work of estimating, the letter is rather vague. The direction was to be kept by a compass and the distance by pacing, and in some instances by chaining. The Biltmore cruiser stick and the diameter tape had not come into use then, so the new men had to caliper the trees for a short period "until such time as the men became competent to judge diameters without the use of calipers". The trees were recorded by species D.B.H. and the number of 16 foot logs. One strip, a chain wide, was taken through each 40, and the estimators had to make a note whether the strip taken was representative and whether the cruise should be increased or decreased by some factor. Barometric readings had to be taken at all important points on the survey, and these readings were corrected by means of readings taken from a barometer left in the camp. Where the country was surveyed, the maps should be made by Land Office surveys; in unsurveyed country the work should be based on watersheds and logging units.

There were plenty of instructions about maps and reports, but there were a few very important details left out. No mention was made of the size of the crew, whether two, three or four men; how they judged the number of logs in a tree; how to use the compass and barometer and how to pace correctly. It must be remembered that for the next few years, not only the students who composed the crews were raw and untrained, but sometimes the chiefs of party were none too experienced.

In May, 1911 the District Forester sent out a supplement to the instructions of April, 1910 in which he got down to more details. He said that the best results were secured by using the strip method with two men to a crew; one man running the compass and the other tallying the trees. The compassman ran the center line for the strip, tallied the distance, took field notes for mapping and aneroid readings. The tallyman recorded the trees 33 feet on each side of the line, and took notes about the condition of the timber and other silvical factors. They still held to the one strip to a forty, which gave a 5 percent cruise, and was for that day the "intensive" method. The "extensive" cruises were the ocular estimates by strip cruises or by sample acres, both of these made without the use of instruments and depending solely on the judgment of the estimator.

There is a memorandum in the old files summarizing the reconnaissance work done in the California National Forests up to 1910. In 1906 Pratt (L.D.) cruised 2000 acres in the Sequoia and E. I. Eldredge 8700 acres on the Sierra. Eldredge, who seems to have been the chief cruiser at that time, covered 50,000 acres in the Inyo and Mono in 1907 (no reasons given) and 57,000 in the Hoopa Valley country in 1908. That year J. R. Hall cruised 35,000 in the Plumas. Needless to say, this was all extensive work. The first big year was 1910 when 308,967 acres were cruised in the Mendocino, Inyo, Klamath, Modoc, Mono, Plumas, Shasta, Stanislaus, Tahoe and Trinity at a cost of \$.031 per acre.

Winter Reconnaissance

This chapter of reconnaissance in California extended over about six winters and can best be dealt with as one episode. It added nothing to the development of timber surveys, but was an interesting experiment that lends color to the history of timber management in California.

Supervisor R. F. Hammatt of the Shasta is generally credited with originating this scheme during the winter of 1910-11. The Klamath intended to do some winter reconnaissance then also, but there is nothing to show that Supervisor W. B. Rider followed Hammatt's innovation. However, the Shasta made enough noise about the project for both Forests and even wrote an alleged song extolling the merits of winter cruising and, incidentally, the Shasta and all the lads. Just what happened in this work during the next winter is not clear except that mention is made of more cruising on the Shasta. In 1912-13 there were crews on the Shasta, Plumas and Eldorado.

A report by Louis Margolin of March 19, 1914 tells of the results of winter reconnaissance during the winter of 1913-14 on the Shasta and Eldorado. Margolin discussed plans and equipment but had little to say about the value of the scheme. He said that the cost depended a good deal on preparations and planning; he believed it to be practical where the snow lies for any considerable length of time and where the topography is not too rough. But, he concluded, that much disappointment would be avoided if it was recognized that winter reconnaissance in any one year is more or less of a gamble.

In the winter of 1914-15 winter reconnaissance was continued on the Lassen and Shasta, and this year Assistant District Forester T. W. Woodbury decided also on Modoc to see for himself what it was like. With Swift Berry he spent about two weeks with the Shasta crew. The party was composed of S. B. Show, Forest Examiner in charge; estimators Lumberman J. C. Elliott and Ranger E. E. Long; Compassmen, S. B. Show and Ranger R. McInroy; cook Ranger Fred Williams.

Parts of Mr. Woodbury's report of February 1, 1915 are quoted as

[The text on this page is extremely faint and illegible. It appears to be a list or a series of entries, possibly containing names and dates, but the characters are too light to transcribe accurately.]

they give an excellent picture of what winter reconnaissance could be like.

Weather conditions were unfavorable during the moving in. Snow light. Shoes sunk in badly. Storming for a portion of the time. Under these conditions took an average of six men about five days to move in about 1000 pounds of dunnage on the Yukon River sleds, a distance of about ten miles, all up-grade. Eighty pounds per man was a good load and six miles was a pretty good day's work. Sled cut in badly and slipped on side hills so that one man was needed to brace it. Under average conditions it is reported that one man can pull 125 pounds and that ten to twelve miles a day can be covered.

"Two days, stormy, were spent in fixing up the one room cabin for occupancy and in getting wood. Provisions brought in by Kotok and Martin White were carelessly stored. Potatoes were not buried deeply enough and were one-half frozen. Other staples left on the floor would have been badly damaged by rats and mice if it had not been for Castle and Hofer, nearby trappers, who took care of them. Kotok brought in 5 gallons of linseed oil instead of kerosene which later caused a two day trip to Medicine Lake to get oil....Takes 1 1/2 hours to get to work and 2 hours to return. Start at 7 a.m., arrive at work 8:30, work until 3 with 30 minutes for lunch, arrive at camp at 5 p.m. which is just about dark at this season.

Skis proved useful in going to and returning from work. The men packed webs on their backs and used them during the day. Both skis and webs loaded badly on warm days which makes walking very laborious..."Snow shoes" were used for the transit and proved satisfactory. They consisted of boards about ten inches square with a hole in the center for the transit leg.

"...Diameters were estimated and checked by taping. The use of tapes is awkward since it is difficult to take a tape around a tree gracefully on snowshoes. The use of Biltmore sticks at eye height with an allowance for taper would work much better...A little experimental use was made of Abney levels in obtaining differences in elevation. I am satisfied they can be used to good advantage by careful men and will give more dependable results than aneroids...

"Winter reconnaissance, as has been said before, is more or less of a gamble on the weather and snow conditions. In settled snow and clear weather a good record can readily be made and the work is agreeable. In new snow and stormy weather it is hard work and the costs are extreme...A job that can be done in four weeks in winter can be done in three in summer, to say nothing of the added cost of moving in. Living in tents in winter does not appeal to me and I don't believe that it would be feasible...where the thermometer flirts around twelve degrees below zero...

On the whole I am not enthusiastic about the all-around worth-whileness of winter reconnaissance except; 1-where reconnaissance is urgent; 2-where areas are impenetrable in summer; 3-when men cannot be used on other necessary work where less time will be wasted in moving in and walking to and from work."

This experience made the District Office rather lukewarm towards winter cruising. But the enthusiasts still continued it until the winter of 1916-17. Some work was accomplished on the Plumas a few miles from Quincy, but the party on the Shasta was 77 percent ineffective because of adverse weather. That disastrous record was the final straw, and the District Forester decided that there would be no more winter reconnaissance unless it was "necessitated by unusual and unforeseen circumstances". It was a good he-man experiment, but it was just one of those projects for which there was not enough demand to make it worthwhile.

Checking Reconnaissance Surveys

In 1911 the California District took up timber reconnaissance seriously. There were 48 men on twelve Forests in crews of from four to six. Forestry school students were picked while they lasted and then boys from colleges, sometimes from the East, were given jobs at \$50.00 a month and expenses. Louis Margolin was in charge of the general work of the section. William C. Hodge, a District Office Inspector, was sent out that summer to check over what had been cruised in 1910 and to see what sort of work the 1911 outfits were doing. He went over the job thoroughly, and his report of October 16 was of great value in managing future reconnaissance. He found that the Forest Service would have to make the work of cruising as mechanical as possible if any sort of accurate results were to be obtained.

Inexperienced boys, some of whom had never seen the woods before, and had no particular interest in forestry, had been trusted as if they were old timber cruisers. The results were a combination of carelessness and ignorance which threw off the figures for some tracts as much as 300 percent. The Forest Service cruiser stick, then simply the Schenck-Biltmore stick, had been used that summer and Hodge suggested a hypsometer attachment and recommended its constant use. He wanted to simplify all instruments and find a barometer which would offer less chance of errors in reading. According to later developments, he was correct for it was not many years before the topographic Abney level and the topographic tape replaced the barometer and pacing. The personal equation was almost eliminated as he had recommended.

Reconnaissance Studies

There is perhaps no other Forest Service activity which had so many persons interested in its development and willing and able

to express their opinions. From 1912 through 1914 the files are full of solid, lengthy memoranda written by Clapp and Greeley from Washington and Woodbury, Hodge, Margolin, Headley, C. L. Hill and D. C. Birch of the California Region. They all had ideas how to improve timber estimating. It was a good, practical subject with which nearly everyone was concerned; and, just to keep their hand in, they revised the reconnaissance manual about every other year.

On the Klamath in 1912 they tried out ordinary intensive (5 percent) reconnaissance, combined with plane table system of intensive reconnaissance. Sidney Stoner, Chief Surveyor, made a 2 inch to the mile map, by methods used by the Geological Survey, of watersheds or blocks of timber which had no great commercial value. Scattering timber was estimated by Oscar M. Ewans using field glasses. Regular strip cruising methods were employed where the timber was thicker and of better quality. According to Hodge, the plane table method gave better vertical control and resulted in improved topographic maps which had been the least satisfactory feature of reconnaissance work. Stoner recommended getting vertical control by means of transit and stadia traverses through or around sections or watersheds. This method had been tried out in District One.

Margolin came out with another scheme of locating timber types while making the timber estimate. This was to be done by recording the volume of each tree or group of trees by species where they occurred on the area. With this data on the map, the types could be outlined accurately. This was called the Clark and Lyford system and was used in British Columbia. A special notebook page ruled into squares representing 10 double spaces, 50 squares to a page, was used; a record of the distance was kept by means of a tally register. This scheme was disapproved by the Forester's office mainly because it tallied the stand by volume instead of by diameters and therefore failed to give a stand table.

There always had been some doubts about the value of a 5 percent cruise which amounted to one strip, a chain wide, through a 40 acre tract. This had been the standard for "intensive" reconnaissance for fifteen years. For checking purposes a 20, or even 100 percent, was made, and the instructions were to use a 10 percent if conditions warranted; but this was not often done. This single strip was run through the center of the forty, across the contours, so as to give the greatest variety of conditions.

To settle the problem Margolin took eight technical men to the Plumas in February to run some experimental cruises. In the party were Ernest Jotter and Oscar Ewans from the Trinity; Kotok, Shasta; Ray Orr, Plumas; Gallaher and Taylor, Tahoe; Wegner, Mono; Hill, Sierra. They floundered around in deep snow on 640 acres for two weeks but proved that the ten percent cruise was much more accurate.

During the summer of 1913, Margolin made further checks on 1560 acres in the Yosemite Park. As a result, they decided it was good business to make a ten percent cruise, especially where detailed figures were desired. This was strongly seconded by Swift Berry and the timber sale men, because errors in cruising seriously affected timber appraisals. Also a much better map could be made by running twice through a 40. This was approved by District Forester duBois in April, 1914, but the ten percent cruise did not go into effect until 1916.

The season of 1914 was productive of several advances in timber reconnaissance besides the ten percent discussion. Hodge advocated a much more scientific tie in of Forest Service maps with the Geological Survey triangulation points and bench marks. He argued that the primary location should be by triangulation rather than by section lines and township surveys. Later this was to be put into effect as the primary control of a timber survey project.

A new set of instructions, the Manual of Intensive Reconnaissance by Margolin, was issued and used that summer. In the fall comments on it were sent in from the Forests. An article appeared in the Forestry Quarterly about the use of the Abney level for contour mapping. Perhaps, as a result, this instrument was tried out by Dwight Birch on the Sierra and Douglas Noyes on the Klamath, both of whom were in favor of using it as a means of secondary vertical control instead of the barometer.

There was still a lot of discussion about how to tally the heights of trees. They had tried estimating the number of logs and then had changed to the quality class of the trees on a 40 acres. At the end of 1914, the majority of forest reconnaissance men were in favor of doing away with the quality classes as being too indefinite for the inexperienced men engaged in the work.

In 1915 W. H. Gallaher was made the new head of this activity.

In June, 1914 Louis Margolin, who had been in charge of the reconnaissance work since 1910, disappeared while travelling from one timber survey camp to another in the Dinkey Creek District of the Sierra Forest. His notebook and part of his clothing was found in the waters of Dinkey Creek. It was supposed that he had slipped and fallen into the stream, which was then swollen to a torrent by the melting snows. His body was never recovered. A graduate of Cornell and Harvard Forestry schools in 1904, he had made substantial contributions to the developments of forest management. The Forest Service had lost a very high type of scientist. A bronze plaque marks the spot where he is believed to have met his death.

Modern Map Making and Timber Surveys

Ever since reconnaissance had begun, it had been an activity

which was about equally divided between getting an estimate of timber and making a map of the tract covered. Map making was a special line of work, but it so happened on the national forests that most of the map making was done in connection with timber cruising. After the first manual on surveying issued in 1907, it was revised in 1913. Instructions for Reconnaissance Surveys and Maps applied to maps for grazing reconnaissance and land classification as well as timber.

Timber reconnaissance was annually bringing out improved methods of map making and, incidentally, bringing out the need for maps especially adapted for Forest Service administration. The Forester sent out in May, 1915 a Manual of Topographic Surveys in the National Forests and followed it in August, 1916 with National Forest Surveys and Maps-Topographic Surveys. This last was very elaborate, nearly twice as large as the one issued the year before. However, the 1915 instructions mentioned the "recently devised special topographic Abney level" used to measure distance with the two and a half chain trailer tape. But it was not the topographic tape which gives slope corrections and elevations. That instrument was mentioned in the 1916 handbook.

The 1916 book got down to fundamentals and told why the Forest Service made its own surveys and how they were to be done. Three standard classifications of maps were set up, ranging from very detailed, accurate and expensive maps, to those adequate for certain classes of work. The ten percent cruise replaced the five as standard and, for all practical purposes, the instructions of 1916 are in effect today so far as timber surveys are concerned. It was almost the end, also, of the hectic writing of timber cruising manuals. Gallaher made some additions to Largolin's work of 1914, and later Oscar Evans was to bring out his manuals of 1932 and 1935. The technique of timber surveys has been improved but not changed in any great detail since 1917.

Timber Surveys

The most important event of 1916 was the change of name of this activity from Reconnaissance to Timber Surveys. It was almost like the much older term of "valuation surveys" (found in the bulletin, Terms Used in Forestry and Logging, 1905) which applied generally to early day timber cruising, although it was defined as being connected with an experimental tract.

The first work, according to the new regulations for primary, secondary and tertiary control surveys, was done on the Stanislaus River and Cow Creek units of the Stanislaus Forest. According to a memorandum by Assistant District Forester Woodbury of March, 1919, that was the only high class topography-"maps which will serve the permanent needs of the Forest, and those maps and one of the Stuarts Fork of the Trinity can be used in compiling base

maps". He did not guarantee the accuracy of any of the others made to that time. It was a declaration that a new era in timber surveys had been ushered in.

PLANTING, -REFORESTATION, -NURSERIES

Southern California, besides being unusual in many other respects, has to its credit the introduction of two main branches of conservation into the State - intensive fire protection and tree planting for the mountain areas. These two forestry activities have a very practical value to those who live between the Southern Coast Range and the Pacific Ocean from Santa Barbara to San Diego. Since the earliest settlement in this region, the inhabitants have found that there was a direct connection between forest fires on their watersheds and their water supply. Fires always meant losses and sometimes death and destruction. They were anxious to protect the cover on their hills and repair any damage done by fire. They didn't object to chaparral as a watershed protector, but they wanted trees if possible. And they had the well known Southern California characteristics of enthusiasm, optimism, and desire for quick action.

In 1899 a group of influential men was gathered by T. P. Lukens into an organization called the Southern California Forest and Water Society. Abbot Kinney, author of the book called "Forests and Water", H. J. Eush, John S. McGroarty, Marshall Harcraft, and Col. Hartwell. The first planting was done by the Government under the direction of T. P. Lukens in 1902 when a large quantity of seed was sown broadcast and in seed spots. There were also some pine seedlings set out with tin around them to protect them from rodents. But this initial experiment was a failure, mainly owing to birds and rabbits. A small nursery was established in Pasadena in 1903 and abandoned because of lack of water. In 1904 Henninger Flats was rented from the Mt. Wilson Toll Road Co. and a nursery established which was in operation by 1905. The next year another nursery was established in San Marcos Pass about 16 miles from Santa Barbara by George W. Peavy, then in charge of Planting in California. He is now president of Oregon State College.

According to a report by E. A. Sterling, Assistant Forester, the two nurseries furnished young trees for the experimental planting in the mountains of Southern California with a capacity of 800,000 seedlings and transplants in 1907 for the San Gabriel, Santa Barbara and San Luis Obispo Reserves, or the Angeles and Los Padres Forests, as they are called now. Sterling was evidently a little embarrassed by the planting problems of that day and in that region, according to his report. He is rather skeptical of the chances of reforestation, owing to the lack of rainfall and the long, hot summers. He is also afraid of the losses by rodents and birds. Not the least of his embarrassment comes from the almost too optimistic cooperation of the people of the sunny Southland who had heard rumors that the Forest Service was going to undertake a general reforestation of all the mountain country there. He wanted it clearly understood

that the Forest Service was determining what could be done and that the work must be considered as experimental. He ends his report - "Let the enthusiasts cease their clamor for action which will make a forest bloom immediately on the scorched slopes of their mountains, and wait with patience the systematic experiments which will indicate whether it is possible and worth while."

The place of planting - either reforestation or afforestation - in that period can be gauged by the report made to the Forester in 1907 by Fred G. Plummer, one of the staff men. He was sent out from Washington to determine the importance of forest extension upon the watersheds of the San Jacinto (Cleveland) Forest, to locate not more than five permanent nursery sites, and to determine what areas in the vicinity of these sites are available for forest extension. His map shows that he considered some 196 square miles on the watersheds of the Cuyama and Sweetwater reservoirs as practical planting projects. He had in mind the use of eucalyptus.

In that year the owner of San Miguel Island off the coast of Southern California asked for a planting plan for 1000 acres. Samuel N. Spring, Chief of the Office of Extension, Branch of Silviculture, reported that 239,000 acres had been planted on the Monterey, Santa Barbara, San Luis Obispo (all now in Los Padres), the San Gabriel (Angeles) and San Bernardino Forests. Altogether, the Office of Extension in those days was an important section of the Forest Service.

It was about this time that an order went out from Washington that all rangers who occupied permanent stations must establish nurseries using the local species of trees. This was not so much for the practical value as it was educational. In order to get the supervisors extension-minded also, they were expected to establish nurseries at their headquarters. This idea only bloomed between 1906 and 1908 and then faded.

The eucalypts were then coming into wide publicity as a sort of all around wonder tree, exactly suited to all of California. In its native country the many varieties of this tree took the place of ash, hickory, oak and maple, as used in the United States for an industrial wood suited for tool handles, pulleys, floors and other uses where strength and great durability was required. In addition it was believed that eucalyptus could be used as lumber, railroad ties, firewood, and of course, as a watershed protection. To make its prospectus complete, it has medicinal qualities and is a remarkably fast growing tree.

The California report for 1908 has this to say of this supposedly magic species: "The almost incredible yield from eucalypts planted in southern California, the rapid increase

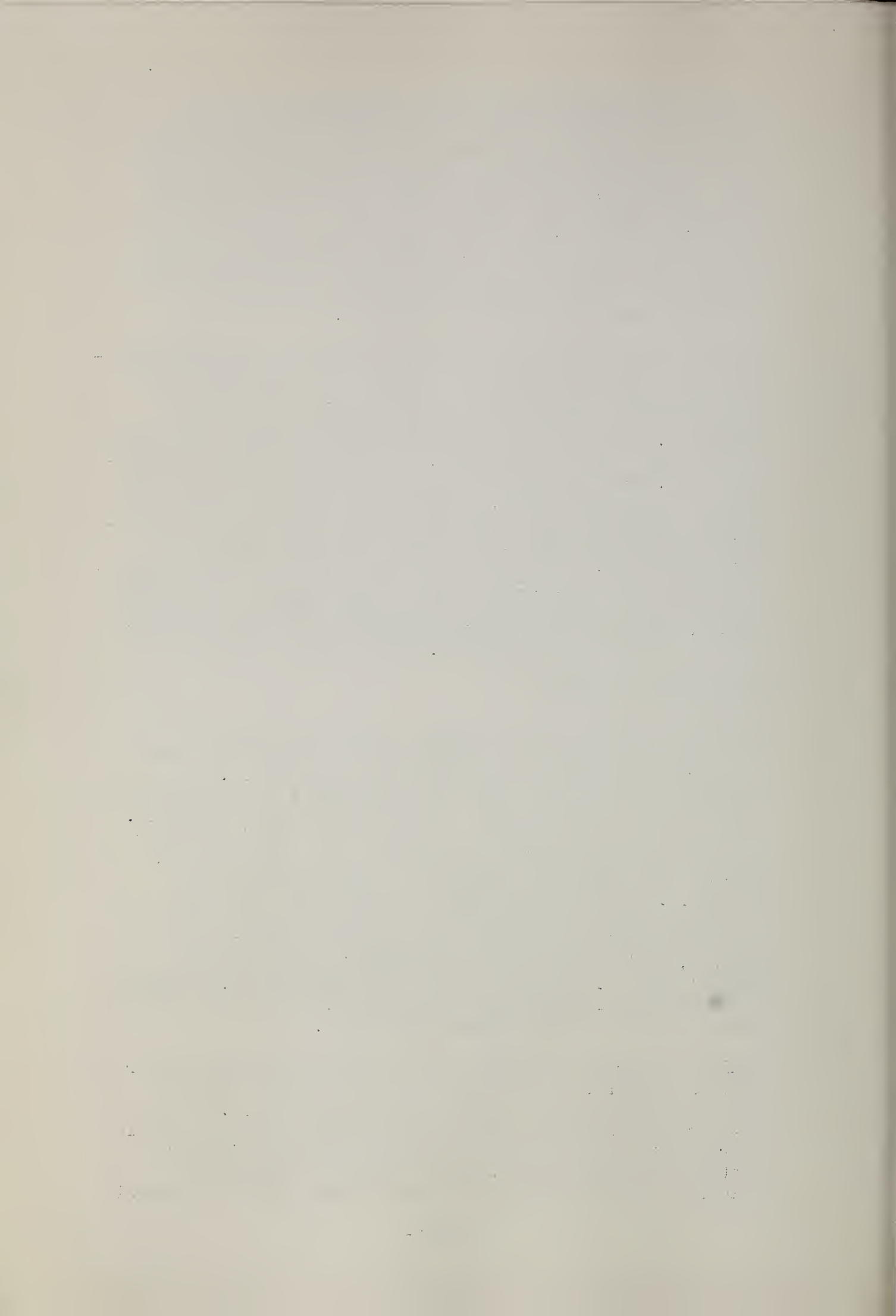
in value of timber products, and the certainty that the eucalypts are adapted to many of the uses for which the most valuable hardwoods are employed, has made the proposition of growing eucalyptus timber for commercial purposes very alluring. However, the extravagant claims made by many of those promoters, whose object seems to be rather to sell stock than to produce timber, will, it is very certain, in the end injure seriously an industry, the product from which is likely to be of such utility in the near future." This subject was considered important enough to recommend the sending of a technical expert to study in Australia.

Between 1908 and 1912, the following nurseries were established for the purpose of growing eucalyptus and then abandoned: Oak Grove on the Cleveland; Los Prietos, Santa Barbara; Merrick Canyon, Angeles; and San Bernardino, then on the Angeles. All but the Oak Grove were started in 1909, and most of them only lasted two years. In the spring of 1910 Forester H. S. Graves had a look around, and in the report made that winter is the statement: "In accordance with the decision to abandon planting in the brush zone, which was arrived at during the Forester's visit last spring, Oak Grove Nursery on the Cleveland, Topa Topa and Blue Canyon on the Santa Barbara, have been abandoned. Lytle Creek is in process of abandonment on the Angeles, and the stock will be transferred to Converse Flat." That meant that conifer planting and seeding, as well as the eucalyptus experiments, were not turning out well.

The Eucalyptus Affair

The Forest Service was in a hurry to get rid of all its eucalyptus experiments, and maybe one of the reasons was the unfortunate reputation this species was acquiring. The eucalypts were getting into bad company and any association with them was avoided by the straight laced Forest Service. A man by the name of Walker is credited with being the first to introduce eucalyptus to California. He is said to have brought some seeds from Australia in 1853 and planted 14 species. In 1860 Stephen Nolan of Oakland went into the business of raising eucalypts for the market and evidently was influential in spreading this species throughout the State. This was aided by the scientific investigation by Elwood Cooper, at one time State Horticulturalist, and Abbott Kinney, a public minded conservationist, who was at one time connected with road and highway planting.

Although eucalyptus was well known in California by the turn of the century, no one had made much fuss over it until the Forest Service began its planting work about 1905. To the reforestation and afforestation enthusiasts of that day this tree seemed to be the answer to the tree planter's prayer - at least for California. By 1910 eucalyptus planting was important enough to warrant a special study by Louis Margolin



as a cooperative project between the Forest Service and the State Forester. Largolin made a painstaking examination with careful estimates of the growth of the different species of this tree as found in plantations in the State. His results were published in Bulletin No. 1 of the State Board of Forestry in January in 1911.

This bulletin was preceded by a private publication written by C. K. Sellers, a former Assistant State Forester of the State Forestry Office. This was called "Eucalyptus, Its History, Growth and Utilization", price \$1.00. It was introduced by a review signed by G. M. Homans, then State Forester, and a preface by G. E. Lull, a former State Forester. Homans review spoke of Seller's work in eucalyptus investigations, the need for the commercial planting of hardwoods suitable for industry, and the possibility of raising a crop of Blue Gum (*E. globulus*, the favorite and fastest growing species in the State,) in an astonishingly short time compared with the native species of hardwoods. He was mildly enthusiastic, but Lull, in his preface, turned on the heat. After warning of an impending timber shortage, accompanied by acute suffering, he said, "Fortunately for California, and for the entire nation, it has been discovered that the wood of the rapid growing eucalyptus forms a substitute for Eastern hardwoods that is even superior to them. This fact has led to the establishment of this wonderful tree just at the time when Eastern competitors are disappearing from the market. What relief this remarkable genus may afford can not now be more than predicted. It promises to be the means of making California the home of the large wood working industries and of causing this State to be even more prominent than did the discovery of gold."

No doubt he was sincere in his predictions, but they were unfortunate in many ways. The effect was a combination stock selling, planting and real estate boom which actually did cause the State to be prominent, not for the success, but because of the failure of the eucalyptus planting schemes. Companies were formed which promised to sell California land at \$250 per acre which included the planting of eucalyptus trees and their care for ten years. At the end of that time it was estimated, on the strength of Seller's bulletin, that there would be anywhere from 25,000 to 100,000 board feet of lumber on each acre. Some of Seller's estimates predicted 213,000 board feet of blue gum per acre by the time the trees were 24 years old. Most of these companies had their own prospectuses - attractive pamphlets, filled with information about the growing of blue gum, and promising profits because of the decreasing supply of hardwoods and the value of blue gum as a fast growing substitute.

Companies were organized as far away as St. Louis Mo., and sale of lands by means of this promotion scheme was very large.

Many inquiries were received by the Forest Service, and by 1912 it was thought necessary to issue a statement which would reach the prospective investors. Circular No. 210, "Yield and Return of Blue Gum" by Assistant District Forester T. O. Woodbury, was given wide distribution. This pamphlet of four pages was based on Margolin's study and gave the cold facts about the probable financial returns from eucalyptus plantation. Instead of 100,000 board feet of lumber per acre in ten years, worth from \$20 to \$140 per thousand board feet, it was stated that the best returns per acre from a ten year plantation of blue gum, which could be expected under the most favorable conditions of soil and climate, was \$160 worth of cord wood, not lumber, per acre. Therefore, all investors who had paid \$250 were bound to lose money. All the extravagant claims of rapid growth and value in the other bulletins were contradicted. It was shown that even a 32 year plantation on the best sites yielded only 58,000 board feet - not 100,000 - in ten years. It had been claimed by quotations from manufacturers statements that eucalyptus was valuable for tool handles, pulleys, etc. It was a fact that it had been used but only in small quantities and as an experimental project. It was found that there was a great deal of waste to the manufacture of eucalyptus articles because of the difficulty in seasoning the wood and its tendency to check; it just was not adapted in this country for industrial uses.

The eucalyptus fever lasted for several years and finally died out leaving many investors, some of whom could ill afford it, with a loss on their hands. So ended the affair of the Eucalyptus "Gold Rush" in California.

By the winter of 1911 Converse Flat on the Angeles was the only active nursery in the south; and it was proposed to settle the future of conifer planting by a series of careful experiments, continued through a number of years, and carried on at Converse Flat and Pilgrim Creek, founded in 1910, in the north. The frost of December, 1912 killed most of the eucalyptus plantations in Southern California, and just about settled that project so far as the Forest Service was concerned. The Pilgrim Creek nursery on the Shasta became the laboratory for the planting experts in the north.

Several matters of historical interest happened about this time which deserve mention and can be fitted into this account here. One was the planting of 17,000 Giant sequoia transplants on many of the northern California forests. This experiment had been fostered by Supervisor A. B. Fatterson of the Sequoia, who had taken a personal interest in trying to grow Big Trees from seed. The planting stock came from the Pilgrim Creek Nursery and was distributed in the fall of 1912 and spring of 1913. For several years these plantations showed promise, but evidently most of them failed with the exception of those on the Klamath, Trinity and Sequoia. The Big Trees in Rider's Gulch on the Klamath have been very successful, and a special record of this grove has been assembled by Assistant Supervisor A. K. Crebbin of that Forest.

Another item of interest in that period was the planting of hardwoods in the Inyo Forest, in the fall of 1910 and spring of 1911, for posts and windbreaks in the Owens River Valley. A wide variety of species were tried out, including locust, white ash, box elder, black walnut, butternut and several other eastern trees. The planting was done in plowed furrows and in pits on fenced, agricultural land at rangers stations in the valley where water for irrigation was available.

Looking over the old reports, the year 1911 seems to be the high tide of planting and the end of the first chapter of this activity in California. The old enthusiasm had not waned nor the youthful optimism changed, as it did to first, skepticism and then to pessimism. In that year there was cooperation with the War Department at Angel Island, Fort Barry and Mare Island Navy Yard, in the San Francisco Bay region; Fort Rosecrans near San Diego, and Hawaii. Many of the groves of eucalyptus, Monterey cypress, Monterey pine and acacias growing on these Government reservations are the result of Forest Service cooperation. One of the early projects was the planting of the Presidio of San Francisco to eucalyptus in which the old Bureau of Forestry had a part. The planting of Yerba Buena, then called Goat Island, was in cooperation with the chambers of commerce of Oakland, Berkeley and San Francisco.

Exotics were tried with such trees as the Japanese camphor, and twenty nine species of eucalypts on the Angeles, Santa Barbara (Los Padres) and Cleveland. A small nursery at the Paso Del Rio Station on the Monterey was established in 1910 to try out five species of acacia. Planting was then really big business so far as the Forest Service was concerned.

The District Forester's report for 1912 gives a whimsical resume of planting results up to that time and is worth quoting. "When in the distant future Forest Service historians chronicle planting in southern California, that particular chapter will, I fear, be cited as an excellent exposition of 'how not to do it'. First will be told the story of T. P. Lukens' efforts (commencing in 1904 on the Angeles) to establish forests of Sierra species in the granitic soil of the hard-baked lower foothills where nothing but dense brush had ever grown. The fight was a losing one from the start, but if perseverance is an indication of valor, then was it waged right valiantly since the cause was abandoned only recently with the establishment of the Converse Flat Nursery and experiment station in the true timber belt at higher altitudes. Parnay (Serope Y.) picked up the work where Lukens left it and carried it on in accordance with the same hopeless policy until Grant (Ranger, James H.) loomed on the horizon in 1909. He was welcomed as a savior and had a brief but brilliant career during which nurseries sprang up like mushrooms in a night on the Angeles, and Santa Barbara as well. This period will doubtless be known as the "Eucalyptus Era".

Owing to the discovery that eucalyptus cannot be grown successfully in pits in the brush, it is rapidly drawing to a close but not without having left an impression, even though slight, on the scenery of southern California foothills. Even the remote Cleveland felt the inspiration of this period and plans were almost matured at one time for covering stern San Miguel Mountains with beautiful (?) groves of eucalyptus.

"In 1906 the Santa Barbara enters the list with Peavy (G. W.) and d'Allemand (B. R. H.) as champions. The San Marcos nursery was established in the brush zone and plantations, principally of knobcone and jeffrey pine, were scattered here and there throughout the areas about the nursery. Later the Los Prietos Nursery was established in the same brush zone and further efforts were made to court success under the most exacting conditions with ill-adapted or valueless species and rodents to cope with.

"While the Cleveland has played a minor part, yet it cannot be ignored. In 1908 Clifford () started activities there. The Oak Grove Nursery was constructed and was continued until 1910. For the work done we have three or four partially successful plantations on plowed land and numerous small plantations and seeded areas of conifers in the lower scattered timber belt.

"Up to 1912 the Forest Service had spent \$80,000 on the southern forests and had absolutely nothing to show for it except negative results "save only a few acres of eucalyptus on agricultural land and a few dabs of knobcone pine. The knowledge gained, to say the least, has been dearly bought."

In northern California the Pilgrim Creek Nursery began to distribute stock in 1911. In the fall, winter and spring of 1910 and 1911 came the seeding experiments on most of the northern forests, totaling 2306 acres. (Secretary James Wilson of the Department of Agriculture had seen a successful experiment in the Black Hills of Southern Dakota and had told the Forester to get busy and sow tree seeds broadcast on all the national forests.) It was figured that they had bought 45 acres of fairly successful plantations for \$37,000 - a per acre figure of \$822. The question was asked, - could not the Forest Service buy all this experience cheaper? - and two recommendations were made by District Forester Coert duBois at the end of this 1912 report: the abandonment of the experimental pit planting in southern California, and the concentration of planting and seeding on the Plumas Forest under the direction of the Feather River Experiment Station. This station had been established that year, and the idea was to experiment there for northern California as was being done at Converse Creek for the south. All, or nearly all, California officials were beginning to acquire a settled conviction that the need for planting did not justify the scale of expenditures

and most of them, particularly the Forest Supervisors, wanted this money spent for fire protection.

Henceforth, planting and reforestation in the California Region were to be on a strictly experimental basis. In 1915 Forest Examiner S. D. Show was transferred to the Feather River Experiment Station as planting assistant with the assignment of taking up a general field and office review of the planting problem. Since 1910 he had been associated with L. I. Kotok in the planting experiments at the Pilgrim Creek Nursery on the Shasta. At that time Ranger Fred W. Graham was in charge of Pilgrim Creek and E. S. Munns of the Converse Creek Nursery. Show spent practically all of 1916 in field studies of the various phases of planting in the Region. The general conclusions were that the value of experimental work was well worth while. Plantations on the Shasta had been examined since 1911 and numerous reforestation experiments at Feather River had been yielding results for two years.

Nineteen sixteen was the end of this chapter of planting and nurseries in Region-5. In 1917 the Converse Nursery was closed, and Munns moved to another assignment; The Feather River Experiment was abandoned by the Forest Service and turned over under agreement to Director E. P. Leinecke, Pathologist and resident representative of the Bureau of Plant Industry. Only the Pilgrim Creek Nursery continued for a short time until the water supply failed.

During 1918 and 1919 planting on a schedule of about 150 acres a year continued under the direction of Show on the McCloud and Mt. Shasta projects. Results accomplished consisted of an improvement in the quality of the stock, the compilation of definite grading rules for stock, and application of results of experiments to nursery practice. In 1920 activities were entirely suspended and planting was non-existent in the California National Forests for several years. The reason given in the report of 1924 was that much better results could be secured in other districts at less cost.

Nineteen twenty was the end of the second chapter in the history of forest planting in the national forests of California. First came the persistent optimism of the initial efforts to plant the sun-baked and chaparral covered mountains of southern California, either to conifers or to eucalyptus, from 1902 to about 1912. Next came the abandonment of the dream of wholesale planting and the introduction of experimental work at the Converse Flat Nursery on the Angeles and Pilgrim Creek Nursery on the Shasta, which lasted until 1920. Then four years passed during which the Forest Service allowed nature to take its own course in reproduction.

The third chapter commenced with a request by the Forester in March, 1923 for a summary of the planting situation in Region-5.

Assistant Regional Forester T. D. Woodbury recommended a ten year period of planting experiments under the direction of the Branch of Research. He suggested that planting be confined to northern forests in typical areas denuded by forest fires in the timber zones, on lands cut over in logging and in brushfields where there was no chance for natural reproduction to establish a forest stand. All of this was to cover about 3500 acres annually; the trees to be grown at the Feather River Nursery. At the end of this period the program was to be expanded, if justified.

This report was written in January, 1924 a few months before the commencement of the worst season for forest fires California has known. Over half a million acres were burned over in the national forests, compared to the average annual area of about 150,000 acres. In 1927 Woodbury sent in a revised report and recommendations. By that time another bad fire year in 1926 had added considerably to the burned over acreage in the national forests.

Following the terrible scorching of 1924, some planting was done in the Antelope burn on the Lassen and in the Sattley burn on the Tahoe with stock obtained for Region 6.

In the revised plans of 1927 Southern California, which had been passed over in 1924, came in for a revival of planting, largely because of the experimental work done by the Los Angeles County Forestry Department. This organization had carried on since 1918 at the Kenniger Flat Nursery in cooperation with local interests, and had continued the planting and seeding experiments in the Angeles Forest. They were determined to find some sort of vegetation, either tree or shrub, with which they could protect the watersheds of their Sierra Madre Mountains. The Los Angeles County Foresters had demonstrated that successful plantations could be established in pits located in brushland, which had been cleared by fire, and in areas cleared of brush where the ground had been prepared by plowing and cultivation, using native species. All of this gave the Forest Service officials the idea that there were possibilities they had not as yet attempted.

In 1926 came the first experiments with machinery, tractors and drags or tractors and road graders, in clearing strips through brush fields in the northern forests. In the light of what had been learned of the value of preparing the ground, it was believed that this mechanical method offered great possibilities; and it was intended to carry this experiment further and determine the best means of reclaiming the brushland areas.

The report of 1927, therefore, dealt largely with brushfield planting in the northern forests. But it recommended that a planting plan be developed for southern forests, and that

planting stock be supplied for educational and demonstration planting which would fit into an experimental scheme. The supervisors of the Angeles, Cleveland and San Bernardino Forests were keenly interested. Some of them had already secured stock and done some demonstration planting. When, and if, these experiments were successful, field planting on a larger scale would be turned over to the supervisors of the four southern forests; until then the Experiment Station was asked to take charge of this work.

That same year, 1927, a nursery with a capacity of 50,000 seedlings was established in Devils Canyon, a few miles north of San Bernardino in the San Bernardino Forest, under the direction of Roscoe B. Weaver, who was formerly connected with the Pilgrim Creek Nursery. The California Forest Experiment Station had charge of this project and also the 50,000 seedling nursery at the Feather River Experiment Station on the Plumas. This station had been returned to the Forest Service in 1926, and was now to serve in the development of nursery and planting technique, research planting in high manzanita and other competing vegetation, such as bear clover and scrub oak.

It was estimated that there were 20,000 acres of burns and cut-over lands on Government property in the northern forests and 166,800 acres of potential timber lands, not restocked, which should be planted, especially the recent burns. It was proposed to establish an administrative forest nursery within, or adjacent to, the boundaries of the Lassen and Plumas Forests where immediate planting problems are located.

In the summer of 1928 the Forest Service moved onto a tract of 7.8 acres near the town of Susanville and commenced work on the fifteenth nursery in the California Region. Junior Forester C. W. Corson was placed in charge of the project, and The Forest Service was well on its way towards a new chapter in planting.

When the planting program began to function in 1929, the Forest Service had spent about \$160,000 in this work in the California National Forests and had practically nothing to show for it except a bulletin, some reports and a lot of experience. Planting activities in 1929 were directed mainly towards preparation for the future, fairly large scale planting operations on recent burns within the eastern portions of the Lassen, Modoc, and Plumas Forests. The Susanville was finished, and a planting reconnaissance was made of proposed planting sites on the Lassen and Plumas. Preparations were also made for a small amount of annual planting on the Shasta, Sierra, Stanislaus, and Tahoe Forests, using surplus stock produced at the Feather River research nursery. The reconnaissance work served as a basis for preparing three year planting plans for the Lassen, Modoc and Plumas, where the work was to be concentrated on the recent burns. The jobs

were to be handled by the district rangers, and it was the desire to establish planting as an important part of a ranger's job wherever this activity was undertaken.

The first large planting in many years was in 1930, when 315 acres of experimental work was done, mostly in the Lassen and Modoc Forests. Of this total, 86 acres were in small plantations on other northern forests and some on the San Bernardino. In 1931, 435 acres were planted at a cost of \$18.02 per acre, which was a reduction over the preceeding costs. All but 52 acres of this total were on the Lassen, Modoc and Plumas Forests. In 1932 there was another trial at planting the brushfields as had been done in 1926. Three and a half miles of 6 foot strips were cleared of brush by a 15 Cletrac with a bulldozer, and the alternate strips planted to ponderosa and Jeffrey pine. There was a distance of 25 or 30 feet between the cleared strips. This was in the nature of an experiment on the Big Springs brushfield on the Lassen. Alternate 6 foot spaces were planted in the fall and spring for comparison, and some of the planting was done in uncleared brush areas. In spite of the cost of strip construction, the average per acre cost of the strip planting was \$24.34, as against \$37.64 where no preparation was made. But the cost of per h. trees planted was \$60.81 for no preparation and \$76.13 in the strips.

Nineteen thirty three was really the beginning of another chapter, not only in planting, but in all forestry activities. But the extra help from the Emergency Conservation Work was not as important in 1933 as in later years. However, 870 acres were planted on the same three northern forests, and the capacity of the Susanville Nursery was raised from about half a million to a million seedlings. It was decided that, aside from the high brushfield areas, Region 5 had no sizeable planting problems. Planting these brush fields, without advance rodent eradication and the clearing of strips, resulted in stands usually not worth the effort and expense. It was proposed that NIRA funds be used to do some fairly large scale and expensive rodent eradications and preparation of planting and seeding sites. The idea was to find out if this sort of planting could be done successfully even if it was expensive.

HISTORY OF FOREST INSECT CONTROL IN CALIFORNIA

Two enemies of the trees in the national forests are the joint concern of the Forest Service and two other bureaus of the Department of Agriculture. Forest tree disease is a special section of Plant Pathology in the Bureau of Plant Industry, and Forest Insects is a branch of the Bureau of Entomology. Forest Pathology has been largely a service of technical advice. Forest Entomology has been advisory and has also carried out control projects in the field.

When the Forest Service assumed charge of the national forests, the administrative control of the Service and the Bureau of Entomology were centralized in Washington. The National Forest Districts were established in December, 1908, and in 1912 the Bureau set up western field stations in Colorado Springs, Colorado; Missoula, Montana; and Ashland, Oregon.

The first authentic records of insect control in the forests of California began in 1907. Dr. H. E. Burke, a retired member of the Bureau, tells of a small control project carried on by Ranger Roger Baldwin in the Santa Barbara (Los Padres) Forest near Ventura where trees were cut to stop the inroads of what was probably the western pine beetle. According to Dr. Burke, it was during this work that Baldwin was credited with the first experiments with solar heat treatment for insect control. In the summer of that year Mr. John M. Miller, now in charge of the Bureau's work in this Region, was a Forest Guard on the Sierra Forest. He discovered an infestation of the mountain pine beetle in the sugar pines and reported it to Dr. A. D. Hopkins, who was in charge of the Forest Insect Division of the Bureau. Miller was then a student of entomology at Stanford and expected to receive a note of thanks, if not of commendation, for this bit of cooperation which was reported to the Bureau through Supervisor Charles H. Shinn. For a long time he heard nothing of it but finally learned that Hopkins had informed Mr. Shinn that the Bureau wanted no insect reports from Forest Guards, and, if there was any technical information to be sent out, it was to be by better qualified men. This rather peculiar attitude helped to aggravate discord which arose a few years later.

Forest Assistant Russell Pond had better luck in 1908 when he reported that bark beetles were doing considerable damage on the Klamath. This report was considered by the Bureau, and Dr. Hopkins advised Supervisor R. L. P. Bigelow, through the Forester, to dispose of the infested trees by selling them and to make a careful check of the whole Forest. S. T. Dana of the Branch of Silvics came out from the Forester's office that fall and reported that *Dendroctonus brevicornis*, the western pine beetle, was found on all parts of the Klamath.

A circular letter from the District Forester in 1909 asked the supervisors to have the ranger force keep a lookout for insect infestations as they went about their other duties - the old way of handling special work. But the discovery of the infestation on the Klamath must have alarmed the District Office for the section of Silviculture, now called Timber Management, recommended that John Miller, who had been promoted to a ranger, be taken from his district on the Sierra and make what was the first insect survey in California. Miller started at the south end of the Sequoia and by June, 1910 had finished his reconnaissance of that Forest. Then the Klamath situation came into the limelight again.

An agent of the Southern Pacific Company named Glendenning had found severe infestations on company land located at Loffit Creek, and the Service had been asked to cooperate. Miller, Glendenning and Assistant Supervisor J. R. Hall made an examination and found most of the damage to be on railroad lands in that section and an infestation of Government lands on Little Humbug Creek. Subsequently, the Southern Pacific took care of the outbreak on Loffit Creek while the Service started the Craggy Mountain and Barkhouse projects on the Klamath. Miller's report of January on this area was a very complete document illustrated with many pictures. Dr. Burke was sent down from Oregon by the Bureau and established headquarters at Yreka while examining the Craggy Mountain area. In November Miller transferred from the Forest Service and joined Burke as representatives of the Bureau of Entomology. Some control experiments were done that year, but the first real insect control work commenced in 1912 on the Craggy Mountain and Barkhouse projects.

Protection of the national forests from fire, trespass, insects, disease and other enemies is an administrative function of the Forest Service. Theoretically, control of insect damage on the public lands of the United States and cooperation with private owners of farms, orchards and grazing lands was the duty of the Bureau of Entomology, another branch of the Department of Agriculture. In April, 1912, the cooperative set-up between the two bureaus was, that the Forest Service would conduct all administrative work relative to insect infestations in the national forests independently, calling on the Bureau for such scientific data as might be available from time to time. All purely investigative work was the function of the Bureau. Cooperative arrangements could be made by the Forest Service with adjacent timber land owners for insect control and the work carried through. But all projects outside the national forests must be referred to the Bureau.

The Bureau had the two representatives in California, Burke and Miller. The Forest Service picked Ralph Hopping, a ranger on the Sequoia, in August, 1912 and made him Forest Examiner in charge of insect control work in the section of Silviculture. Hopping had served five years as ranger and his entomological

knowledge was what an intelligent and ambitious person could learn by practical experience and study. Burke and Miller were college trained men with civil service standing as entomologists. Miller had served as forest guard on the Sierra while attending college and was a ranger in 1909, assigned to insect work. Four other members of the Bureau, Glendenning, Sullivan, Angel and Riggs, were involved in the work on the Klamath and in the northern part of the State.

The work on the Klamath was done in the spring months of 1912, and in July the first report was out. In December a request was sent to all supervisors to report on the status of insect damage on the forests so that the work for 1913 could be planned on the basis of the most urgent needs. It began to be evident that insect reconnaissance was going to be one of the most important parts of the whole activity. Normal, or endemic infestations, were to be taken care of by the regular forest forces by timber sales or by felling the trees, peeling the bark, and burning the bark and stump before fire weather commenced in the spring. Epidemic infestations were to be controlled by special projects where the Forest Service, or the Service in cooperation with land owners, furnished money to hire labor, assisted by Forest officers, to do this work. The district rangers would then take care of the normal infestation. Miller and Burke moved their headquarters from Yreka to Ashland, Oregon in 1913.

The outstanding incidents in the early years of insect control were those connected with the controversial theories of the Forest Service and the Bureau of Entomology as to the proper methods of procedure in control work. When this was finally cleared up in 1920, a cooperative procedure was established which has changed very little in the last two decades.

Hopkins vs. Hopping

Insect control measures were new to the Forest Service personnel and also to the representatives of the Bureau of Entomology in California. But there was a difference in their attitudes towards the work. The Bureau men were confined to methods of control established as a result of work done in other parts of the country and as a result of research in other parts of the country by the Bureau of Entomology. The Forest officers were unhampered by any established methods. The one group took their orders from Washington, and the other were free to do or say what they thought best for the better conduct of the work. Another way of expressing it would be to say that the Bureau men were guided by a scientific investigative system and the Forest Service men from practical experience.

The Bureau believed that infestations could be controlled by treating 75 percent of the infested trees on an area. Hopping

claimed, after an examination of the 1912 work on the Klamath, that there was still considerable infestation, enough so that it was going to take two or three cleanings before the damage was reduced to normal. This was in December, 1913. About that time Acting Supervisor J. R. Hall sent in a report on recruising the 1912 work on the Klamath, and in the course of the report made some remarks about two Bureau men. Dr. Hopkins of the Bureau interpreted these as meaning that Hall did not think the Bureau men were worth their board. This was not exactly the case and it was so explained, but it added one more to the score. The next incident, which happened almost immediately, was the forest fire-insect infestation controversy.

George H. Rhodes, Secretary-treasurer of the California Forest Protective Association, wrote asking that specific information be furnished him on the relation of forest fires and subsequent insect infestations. It seemed that the idea had gained credence that the prevention of fires resulted in an increase of destructive insects, and he wanted correct information for the use of the timber owners forming the association. This letter was sent to the Forester, who referred it to the District Forester at San Francisco, who, in turn, asked the office in Missoula what District One's experience had been. On January 7, 1914, the District Forester wrote Rhodes that fire is the most dangerous factor in spreading insect infestations. In District One all but two important insect troubles had their origin in fire damage; in California the same was true to a less extent.

Meanwhile the Forester casually informed the Bureau of Entomology of this matter and told them that the District Forester had answered Rhodes letter; incidentally, he understood that the Bureau had some information on the subject which Mr. Rhodes would be glad to have. As a matter of fact, according to the agreement of April, 1912, Rhodes' request should have been referred at once to the Bureau without any opinions from the Forest Service. Dr. Hopkins of the Bureau wrote at once to Rhodes and said that the relation of fires to insect infestations was a very complex question which had been under observation for a number of years. He sent a copy of a circular in which the statement was made that "injuries by fire are not as a rule an important factor in contributing to subsequent depredations by barkbeetles.

When the Bureau found out what the Forest Service had said on this subject, which was very soon, hostilities began in a mild way. Dr. L. O. Howard, Chief of the Bureau, suggested that the District Forester had violated the agreement - unintentionally of course - and deplored that two different agencies of the Government had given out such divergent views on a matter on which only one of them should have given any advice. The Forester denied that it was a violation because, he said, Mr. Woodbury had only expressed his private opinion and he offered to make this clear to Rhodes. Dr. Howard said to forget the whole thing, but Dr. Hopkins came back with a

long memorandum, based on opinions from some of his field men, which refuted the theory that by itself fire caused insect damage. Their contention was that there must be an epidemic infestation on hand at the time of the fire to result in subsequent damage. Fire alone could not create an epidemic. The Forest Service allowed the Bureau to have the last word which was to the effect that the information Woodbury conveyed was not in accordance with the observations of men who had made a special study of the subject and "who have the advantage in a knowledge of the various insects involved". The District Office merely remarked to another District that the Bureau was apparently "biased and unfair", and that it was impossible to work in harmony with them. It was, in fact, the last active cooperation until 1920.

Two years passed during which the Service continued its control work in the Klamath, Lassen, Sierra, Trinity, Mendocino, Shasta and Stanislaus. On the last named a large cooperative project had been carried out with the Yosemite Lumber Company and White and Friant, a timber holding company, in 1915. This was called the Bullock Project. Afterwards this work was continued under supervision of the private owners with the Forest Service as a contributor of advice and money to cover the small amount of Government land in the area. The McCloud Lumber Co. began insect control in 1913 in cooperation with the Service for a year or two and then carried it on alone until 1916. In the course of this experience Hopping had been making notes on different phases of the work and in February, 1916, submitted a tentative report to the Forester. This was revised and issued in March. The theme was that insect control must, to be successful, include treatment of the limbs and tops of all trees because primary and secondary borers bred there and could cause other infestations amounting to epidemics. The Forester submitted an extra copy to the Bureau of Entomology, and the fireworks commenced again.

The Bureau Chief, Dr. Howard, said that the report duplicated research then being carried on by the Bureau, and that entomological investigative work by the Forest Service was against the policy of the Department of Agriculture. Furthermore, the subject matter had been presented "in such a manner and with such erroneous interpretations of some of the facts as to appear to discredit the results of investigations of this Bureau". He strongly suggested that this kind of work by the Service should stop. The Forester replied that the Forest Service was charged with the protection and administration of the national forests, and the work that Hopping had been doing clearly came within that category and was not in the class of research investigations. He regretted that the efforts of cooperation on the part of the Service were not yielding the results he desired and hinted that there would be no more requests for help from the Bureau. Dr. Howard regretted, in return, that the Service could not see that it had been doing work which belonged

to the Bureau and asked that, at least, they would restrain Hopping from criticising the work of the Bureau. The Forester wound up this chapter of the cat fight by asserting that Hopping was only reporting on the results of administrative work the same as other officers.

By this time both chiefs had probably become a little uncomfortable by the thinly veiled acrimony of the correspondence and wished some way could be found to close the subject. The higherups may have felt this way, but there is no doubt that Hopping did not, for he was living up to his name in his apparent delight over the tempest he had stirred up. He followed two Bureau men on a Klamath project and rechecked their reconnaissance work; and in June, 1916 wrote a detailed report in which he concluded that the Bureau men did a careless job, both of managing the control work in the first place, and then of checking the results of the work. He wanted the Forester to send a Washington office man to see for himself. This was one too much for Mr. Graves. He began to suspect that there had been a failure to grasp the problem of insect control "in a large way". There probably had been a failure of minds to meet, and he "should have scant sympathy with any effort to continue the old controversy". Plaintively, Hopping wrote "I care nothing about the controversy. I am after the best methods of controlling infestation. If the Forester wishes me to follow blindly methods advocated by the Bureau, whether such methods are successful or not, I will do so."

Looking at this episode after twenty years, it does not seem possible that the responsible heads of these Government agencies could have carried on what seems, now, a somewhat asinine affair. Both sides seem to have put their personal dignity before the good of the work. There was only petty squabbling where there should have been the best sort of cooperation for the good of conservation. It is the only case of its kind on record - so far. It is mentioned in this detail to show what can happen inside one department of the Government.

Light Burning and Insect Control.

One more event was to mark 1916 as a controversial year in insect control. Along in the fall Stewart Edward White called on District Forester duBois and, in a friendly conversation, criticized our method of insect control on the ground that it did not completely destroy the beetles and stop the infestation. It was true that some of the early work, especially on the Klamath, failed to stop the damages and that the infestation seemed worse a few years later than it had been originally. DuBois offered help to conduct an experiment with White on the White and Friant holdings to see if the method of burning he advocated would be any better than the sort used by the Service. All cooperative arrangements were made but White never carried out the burning. Instead, without another word to the Service,

he wrote an article, "The Tree Killing Beetles of California and Possible Remedies", which came out in the December 9 issue of the American Lumberman. Not a very sporting thing to do to say the least. To make the article a little bit more obnoxious, the editor quoted, without permission, a story written by Supervisor Benedict for the Forest news letter, the "Sierra Ranger", in which it seemed that White's criticisms of the Service methods of insect control were also his criticisms, and that he was defending White. Benedict was also surprised by the article, for White had talked with him that summer, and Benedict had told him there was no such thing as "light burning"; that the sort of burning White wanted had to be done in the most dangerous part of the fire season. Benedict had also offered help if White wanted to do some burning on his own land. White's arguments rested on the assumption that insects, which attacked live trees, were bred in dead and decaying wood, a theory which has been refuted in articles and bulletins by the Forest Service times without number. But this theory never dies; it can't be killed, for, like the mythical phoenix, it rises from the ashes of every large fire in the timber belt of California where dwell the inconvertible adherents to the light burning or Indian system of silviculture. White practically duplicated this episode with a similar article in the Sunset Magazine in February, 1920.

Expenditures for insect control were curtailed during the war years of 1917 and 1918. Cooperation between the local entomologists of the Forest Service and Bureau of Entomology became almost cordial, although Hopping kept reiterating his opinions as against those of the Bureau. He left the question of appropriations for 1919 and 1920 up to the conference to be held in Ashland, Oregon in advance of both of those seasons, because, so he said, he could not bear to "see money wasted by Bureau methods". But this was about Hoppings last chance to criticize the Bureau. He resigned in December, 1919 to take a more important and better paying position with the Canadian Forest Service. Hopping had actually accomplished much in his seven years as entomological expert for the Service. He wrote the first manual of insect control in 1914, developed control technique, gave advice to other regions, and advanced and defended theories which later proved to be sound. His position was never filled. Several other events occurred during this period, not connected with this controversy, but which, nevertheless, have historical value.

Three insect control conferences were held at Ashland where entomologists and timber management officials in the western districts talked over results and made plans for future work, particularly experimental projects. The conference of 1919 recommended the San Joaquin experiment. This was to succeed two other smaller ones, started on the Sequoia several years previously, known as the Kaweah and the Kings River Projects. Such schemes as trap trees and solar heat, or the exposure of

of the bark to direct sunlight after felling to kill the broods of bark beetles, were tried out. But the Kings River area was in the proposed extension of the Sequoia National Park and, therefore, out of bounds, and the Kaweah project was considered too small in extent to prove anything of value to large areas of commercial timber.

The first mountain pine beetle infestation (*Dendroctonus monticolae*) was reported in 1911 by C. Stowell Smith, then chief of the District branch of Products. This outbreak occurred in the lodgepole type in the south eastern part of the Lassen Forest. In 1912 a timber sale was made with the Western Timber Treating Company for half a million poles which the newly formed concern intended to season, treat with a preservative, and sell to power and telephone companies. The promoter of this organization was W. R. Wheaton, an ex-Forest Service man, who had been formerly in the timber treating section of Forest Products. The Service felt pleased as it had pushed this sale in order to clean up the infested lodgepole - probably the first time forest management had been called in to check a bark beetle attack. No doubt the plan would have been effective except that Wheaton's company fell into difficulties from the start. There was a shortage of money and a lack of market. Most important of all, there seemed a lack of poles of merchantable size in spite of a generous estimate by the Service. The company treated no timber and built no improvements and just naturally quit after struggling along for three years.

The Service was willing to cancel the contract without damages and did so, but that was not the end of the story. Wheaton sued the United States on the ground that his company failed because the Service had misrepresented the amount and value of the timber. The case was tried and dismissed in 1921 which went to prove that buyers had to beware when they bought timber from the Government.

The San Joaquin Experiment

The year 1920 started with two important events; the Secretary of Agriculture, E. T. Meredith, revised the principles of cooperation between the Bureau and the Service, and the San Joaquin Experiment was approved by the Forester. John H. Miller came down from Ashland to take charge with headquarters at Northfork in the Sierra, and work commenced on what was to be the chief entomological activity for the next five years.

The San Joaquin project covered an area of about 150,000 acres, embracing the front of the sugar pine belt in the Sierra Forest. This country had been partly worked over for beetle control from 1912 to 1917 by Chester Jordan, Ernest Dudley and John Miller in Forest Service projects and from 1915 to 1918 by the White and Friant Company. It was now to be a general proving ground to determine the best control technique. One

of the important problems was whether to clean up the beetles one hundred percent and then cease operations entirely, or to treat the endemic infestations as they arose and maintain a patrol of the area to catch the spots as they came out. In a way it was reviving the old question of what percent of the infested trees should be treated in order to maintain control of insect attacks.

The project folded in 1924 and the net results were: 1 - The costs of maintenance work were too high to keep up every year unless a 100 percent clean up the beetles was made; 2 - It is important to keep up the detection system for bark beetles and it must be done by special men. According to Miller, the scheme of trusting to rangers to keep their eyes open for infestations worked fairly well when the rangers could calmly contemplate the scenery with their hands on the saddle horn while travelling the trails three miles an hour. But it no longer was of any value since Forest Officers clung to the steering wheel with their eyes glued to the mountain highways; 3 - Emergencies must be met as they arose; when epidemics developed they should be fought immediately.

Other conclusions of the San Joaquin Project, according to Miller's report of October, 1925, were: Control measures are slow and expensive and can be justified only for the suppression of epidemics in merchantable timber; epidemic conditions are present when losses amount to 100,000 board feet of merchantable timber per section; no method of attack had been found which would effectually ward off the rapid development of an epidemic when natural conditions favored increase of insects; forty percent of the average losses are due to endemic conditions. Finally, he concluded that a well planned investigative program was needed more than experimental projects.

A start had been made in technical studies during the progress of the San Joaquin project. H. L. Person, a member of Miller's staff, carried on investigative work on the Sierra to determine the efficiency of trap trees, methods of solar heat control, the possible use of predatory insects to combat bark beetles and a study of cut-over timber sale areas to determine what classes of trees are subject to attacks and which are the most resistant. This last study was of the greatest value in timber management for it was intimately connected with rules for marking timber and tied in with Duncan Dunning's investigations. Person continued this line of investigative work establishing sample plots in different parts of the region to show tree selection by the western pine beetle. He transferred to the California Forest and Range Experiment Station in 1930.

One of the reasons for closing the San Joaquin Project was the threat of a serious infestation in the northern part of the State. There had been trouble in the Modoc country and in southern

Oregon for several years. Mr. J. A. Jaenicke, Entomologist for District 6, had spent considerable time in California in surveys and examinations and had assisted in experimental work. Naturally, the insect problems in that territory were common to both regions. The annual report for 1920 said that the epidemic of western pine beetle in the Warner Division of the Modoc seemed to have declined. But in 1922 it was estimated that 100 million feet of stumpage was lost to Government and private owners on 430,000 acres in the Happy Camp-Lava Beds District. At the same time there was a serious outbreak along the Eel River drainage on the Mendocino. In 1923 the Mendocino trouble declined as rapidly as it had developed and there was also a general slackening of the Modoc attack. The next year conditions again became so serious that it was evident the Service, the Bureau, and private timberland owners in northern California and southern Oregon would have to wage a defensive campaign.

Northern California Control Work, 1925-1930

In the spring of 1925 Miller and his staff moved from Northfork to Stanford University where Dr. Burke, then in shade tree work, had established a branch office of the Bureau. This remained the headquarters until 1931. The events of the next five years center mainly in the northern part of the State, although there was an infestation in the San Bernardino which was controlled by Supervisor J. B. Elliott in cooperation with private owners of recreational lands.

Mr. F. P. Keen handled the Southern Oregon-Northern California project, and found time to do some extension work and write a bulletin, "Insect Enemies of the California Pines", which was published by the State Department of Natural Resources in 1928. He also revised the Insect Control Manual in 1927. Keen was in the Bureau before the World War and, after his discharge from the army, he rejoined the Bureau and had been a member of the staff since 1921. In 1930 he was placed in charge of the Bureau's branch office in Portland, Oregon.

The big event of this period was the timber sale agreement made with the Pickering Lumber Company for cooperative insect control on Government and company lands in the Modoc country. In consideration of a reduced stumpage price the company was to log infected timber where the losses amounted to three percent of the stand. The company was to carry on control measures on Forest Service lands in connection with adjacent company lands. The important feature was that the Service was combining insect control with timber sale work. About \$300,000 were spent by the Government and the company on this area by 1930 when Mr. W. A. Pickering, the president and moving spirit in the company, died. At the same time the infestation slackened, and the company went into the hands of a receiver, but continued control work in 1931 when the bark beetles began a comeback.

The winter of 1931-32 was unusually severe in the northern part of the State. Examination of bug infested trees seemed to indicate that the winter broods of the bark beetle were frozen and that the epidemic must be at an end. But this wishful thought was far from being fulfilled. Not all of the broods were killed; the strongest ones survived and, aided by subnormal precipitation for a series of winters, commenced the most disastrous epidemic the State had ever known. Control work was necessary on the eastern part of the Modoc, Lassen and Plumas and on the southern part of the Stanislaus, the Sierra and Sequoia. It was estimated that a billion and a half feet of timber was killed. Where in former years 100 bug trees to a section seemed to be an epidemic, now there were 1000 in many localities. The unemployment relief policies, beginning in 1933, have been utilized to mop up these areas, and the average annual expenditures for control work in the California forests have averaged \$160,000 since then.

Late Developments in Insect Control

Since the beginning of insect control work in the California Region, there have been, as was explained by John M. Miller, three changes in the conception of the problem. First, it was considered that bark beetle control was a simple matter of treating infested timber to get rid of one of three or four species which were causing trouble. With this accomplished it was expected that the damage would stop. Next, the forest entomologists began to see that forest fires and climatic changes influenced the beetles. Old burns on the Sierra were studied, and it was found that while bark beetles were attracted to fire scorched timber there was no certainty that an epidemic would result. Now it is known, by means of the system of sample plot surveys started by K. A. Salman in 1931, that *Dendroctonus* infestations are preceded by the flat headed borers for from three to five years. Such attacks do not degrade the lumber manufactured from trees attacked by the borer so that a potential epidemic can be averted by selling the infested timber.

In 1937 the Bureau made 29 special reports dealing with conditions in areas covering a million and a half acres. These plots are about half a section in extent and represent key types and conditions which are subject to attacks from bark beetles. When any indications of trouble are found a study is made to determine the aggressor insect. Sub-stations are located on Hat Creek in the Shasta and at Miami on the Sierra. The survey record over a number of years gives the trends of infestations and enables the Bureau officials to make fairly accurate predictions, but they do not attempt long range forecasts.

The 1937 report states, "For the past twenty years 'the pine beetle problem' has been recognized as the outstanding phase of the complex forest insect situation in the California Region." The chief projects now are: 1 - A hazard inventory of

the pine areas; 2 - Determination of tree susceptibility and salvage experiments; 3 - Biology and control of economic insects of the Region.

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