The Allegheny Hardwood Forests of Pennsylvania

Their bounty of timber and deer are the results of events that occurred many years ago

by David A. Marquis

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6816 MARKET STREET, UPPER DARBY, PA. 19082
F. BRYAN CLARK, STATION DIRECTOR

The Author

DAVID A. MARQUIS received his bachelor of science degree in forestry from the Pennsylvania State University in 1955, and his master's and doctoral degrees in forest ecology and silviculture from Yale University in 1963 and 1973 respectively. He joined the Northeastern Forest Experiment Station's silviculture research unit in New Hampshire in 1957, where he studied problems of regeneration and thinning in northern hardwoods. Between 1965 and 1970 he served on the timber and watershed management research staff at the Station's headquarters in Upper Darby, Pennsylvania. Since 1970, Dr. Marquis has been project leader of the silviculture research unit at Warren, Pennsylvania, where he heads a program of research on problems related to the regeneration and culture of high-value hardwoods on the northern Allegheny Plateau.

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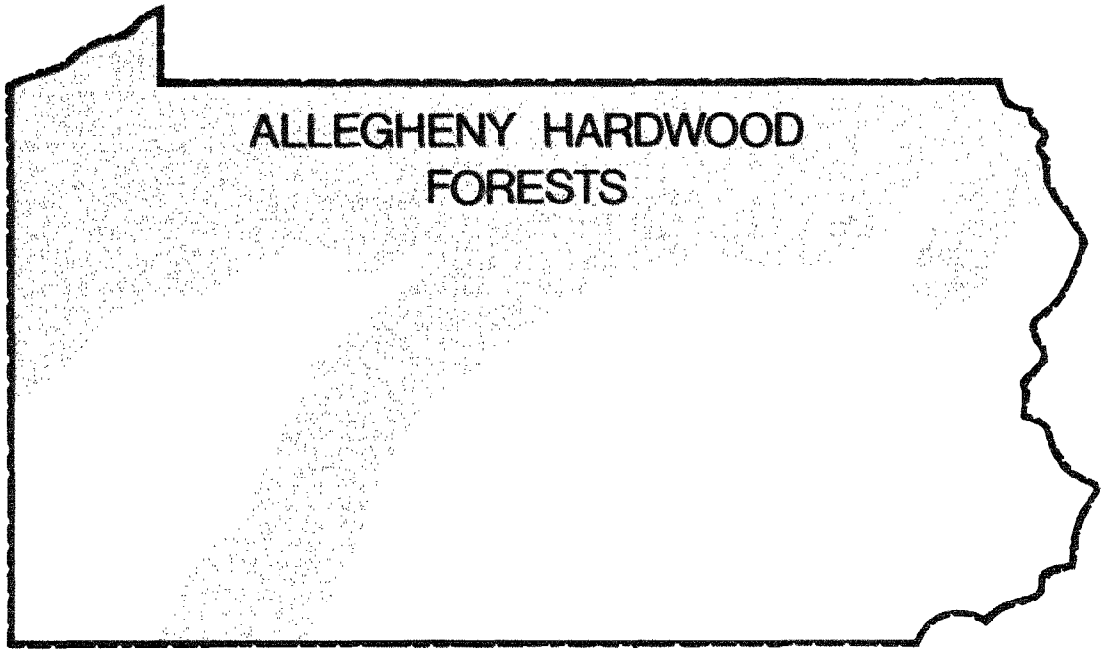
ABSTRACT

Difficulties now being experienced in obtaining natural regeneration of Allegheny hardwoods after forest cutting have been puzzling, for the current cuttings are similar to those that produced the excellent stands present today. A search of historical material in northwestern Pennsylvania provides much insight into the changes that have occurred in forest conditions from the days of the Indian through the era of white settlement and industrial development up to the present. Two major changes seem to account for the present difficulties: a much larger deer herd now exists so that deer feeding on tree seedlings has become a major factor preventing new forest establishment; and present stands lack the well-developed seedling understory that was present in the original forests as a result of their overmature condition and long history of partial cutting. Thus the problems we now face in forest management as well as the bounty of timber and deer that we now obtain from these Allegheny hardwood forests both had their origins in events that occurred many years ago.

COVER PHOTO.—A magnificent black cherry tree on the Allegheny National Forest. Black cherry is the most valuable of the species in the hardwood forests of the Allegheny Plateau.



The Allegheny hardwoods occupy the Allegheny Plateau in northern Pennsylvania and reach southward along the Appalachian highlands.

THE ALLEGHENY PLATEAU of Pennsylvania is blessed with fine forests of black cherry, white ash, sugar maple, red maple, and other hardwood species. These forests are a dominant factor in the pleasant environment of the region, and their products make major contributions to the economic and social well-being of many communities both within and outside the Plateau.

Allegheny hardwood forests provide the raw materials for a large and important wood industry. On the Pennsylvania part of the Plateau alone, there are some 670 wood-industry plants providing a payroll of about 140 million dollars to their 24,000 employees, and adding more than 275 million dollars to the economy each year (*Pa. Dept. Comm. 1972; U. S. Dept. Comm. 1971*).

Almost all the commercial black cherry timber in the country comes from the Allegheny Plateau. Factories as far away as South Carolina and Michigan depend upon this source of supply for the raw materials they need to produce fine furniture and veneer for cabinets and paneling.

Although commercial black cherry is unique to this region, the other hardwood trees on the Plateau are no less important.

White ash is the long-time favorite wood for such products as tool handles and baseball bats. Those Louisville Sluggers that are used to pound out home runs in major league parks

Many of the original forests on the Allegheny Plateau contained large mature and overmature trees—white pine, hemlock, beech, chestnut, black cherry, ash, oaks, and maples.

throughout the country may be manufactured in Kentucky, but the wood used in those bats very likely came from ash trees grown on the Allegheny Plateau.

The maples are well known to everyone as sources of lumber for furniture, for specialty products such as bowling pins and bowling alleys, for maple syrup, and for their spectacular orange-red fall foliage.

All of these Allegheny hardwood species—cherry, maple, and ash—have timber values that rank them among the most valuable woods in the world.

Allegheny Plateau forests yield many social and economic benefits other than timber products. Deer hunting is one major example. Pennsylvania ranks first in the nation in the sale of hunting licenses: between 100,000 and 145,000 deer are harvested annually (1967-72) in Plateau forests.

The direct expenditures for hunting by more than 80,000 deer hunters are estimated at over 100 million dollars annually. These figures tell only part of the story, however; for deer bring incalculable enjoyment to thousands of others who get their pleasure simply by observing or photographing these animals in their natural environment.

Fishing, hiking, camping, water sports, bird-watching, nature study, and other forms of outdoor recreation must also be added to the list of benefits derived from Allegheny hardwood forests.

Tracing the Problems

But there are problems in managing these forests. One very important problem is a difficulty in establishing new seedlings in areas where trees have been harvested for timber.

In setting up a program of research to find solutions to this problem, scientists of the Northeastern Forest Experiment Station could not help but wonder why such a problem should exist now. After all, nature established the existing forests 50 to 100 years ago without any help from foresters. In what ways are conditions so different now?

In searching for an answer to this question, I examined many historical documents describing the forest conditions and the settlement of northwestern Pennsylvania.

Although the information presented here probably applies generally throughout the Allegheny Plateau, most of the historical sources examined refer specifically to Warren, McKean, Elk, and Forest Counties in northwestern Pennsylvania. This is the heart of the Allegheny hardwood region; the Allegheny National Forest lies entirely within these four counties.

Comparatively little information about forest conditions was found, but what data and descriptions there were, combined with our current knowledge of forest ecology, provide a reasonably clear picture of just what is different now and how the present conditions came into being. Both the benefits we realize and the problems we face today can be traced to events that occurred many years ago.

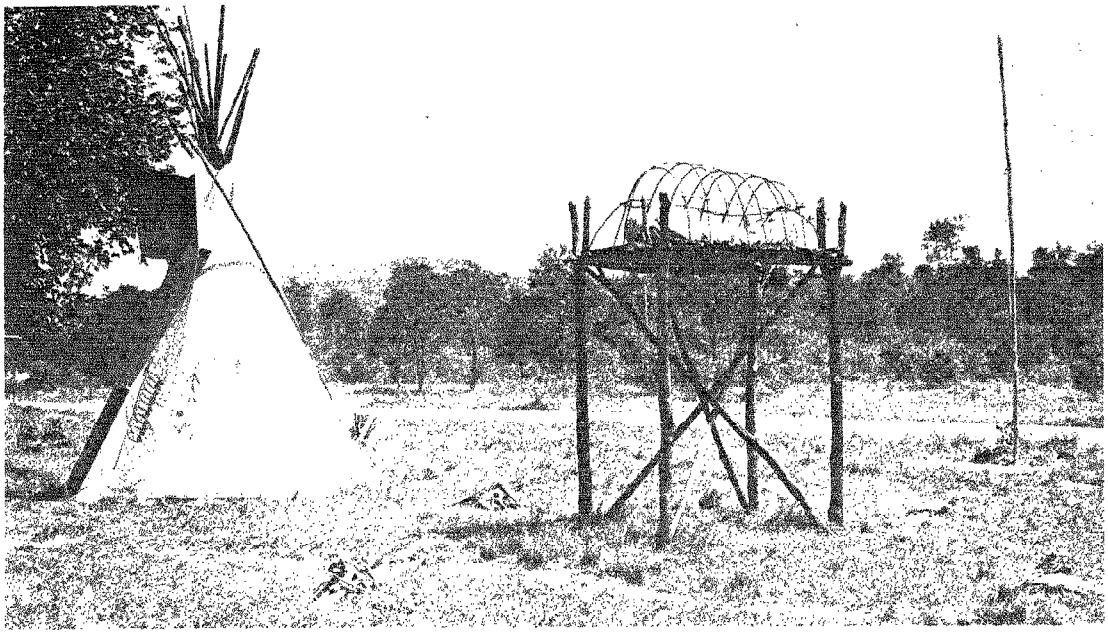
Original Forest Conditions During Indian Times

The original forests of Pennsylvania covered nearly the entire land surface, except for a few natural meadows and rough mountain tops (*Illick 1923*). Many of these original stands were mature or overmature, containing trees of very large size.

This does not imply that all forests were primeval in character; disturbances such as fires and windthrow were apparently common (*Lutz 1930a*), so that there were many stands of different ages and species mixtures, representing various stages of recovery from natural catastrophies.

Indians were responsible for many forest disturbances. Almost all northeastern Indians lived in villages; they cleared land for these villages and for agriculture, and cut trees from adjacent areas for firewood. They often set fire to the woods to increase berry production, facilitate travel, and improve visibility, perhaps as an aid in hunting. Indian villages were relocated rather frequently as soil and firewood were depleted, so that the total area affected was considerably larger than that actually being used at any one time (*Day 1953*).

The Indians who occupied the valleys of the Allegheny River and its tributaries in northern Pennsylvania before the coming of the white man were Senecas. The Senecas were



A replica of a Seneca Indian teepee and burial platform. The Allegheny Plateau was Indian land; and the Indians cleared land for their villages and fields and burned the woods to aid in hunting and improve berry production.

members of the powerful Iroquois Confederation, which also included the Mohawks, Oneidas, Onondagas, and Cayugas (*Schenk and Rann 1887*).

Although there are reports of Seneca cornfields covering 500 acres or more along the Allegheny River north of Warren (*Day 1953*), and although there is much evidence of burial mounds, Indian stockades, and early earthworks (*Lobeck 1927*), there is very little solid information about the extent of their activities or their impact on presettlement forest vegetation.

However, Indians probably did have some effects. For example, it seems likely that the existence of the oak type along the Allegheny River and its tributaries is the result of fires set intentionally or unintentionally by Indians who lived, hunted, and traveled along the river. (Oaks are better adapted to resprout and survive after repeated fires than most other species.) Under our current forest fire protection programs, these oak stands are gradually being converted to other species.

Original Forest Types

The forest types that were present before white men settled here were somewhat different from those present today. Most of the same species are still here, but their distribution and relative abundance have changed. Hough and Forbes (*1943*) recognized three types of presettlement stands:

1. White Pine. These were relatively pure stands that occurred in small well-defined areas—areas measured in tens rather than hundreds of acres. American chestnut, red maple, and oaks were often associated with the pine in these stands; but beech, cherry, and sugar maple were uncommon in this type.

Pure white pine stands generally originated after catastrophies that wiped out the preceding stands. Droughts followed by forest fires are known to have been the catastrophic agents in some cases, windthrow in others. In one virgin stand, it has been estimated, there were 85 fires from 1727 to 1927 (*Lutz 1930b*). Day (*1953*) suggested that abandoned Indian

clearings often grew up to pine. Pine stands occurred mostly on sandy river flats and terraces and on lower slopes where the soil was loose and sandy (*Loboch 1927*).

2. *Hemlock-Beech.* Hemlock and beech were by far the most common species in original stands on the Allegheny Plateau. Together, they represented 58 percent of all trees observed in early land-surveys of the area that is now the Allegheny National Forest (*Lutz 1930b*). They frequently occurred together and probably represent the true climax type of the area.

Although both species are tolerant of shade and will reproduce beneath their own canopies, the occurrence of both species can often be traced to periodic catastrophies (*Hough and Forbes 1943*). Hemlock was most abundant on moist sites along streams and poorly-drained uplands where it was protected from the periodic fires that burned through the area.

3. *Beech-Maple.* Sugar maple, an associate of the hemlock-beech type, often replaced hemlock as a major component. Sugar maple is also a shade-tolerant climax species, although it is less shade-tolerant than either of the other two.

Beech-maple stands were more common on the better drained or less moist areas, perhaps because hemlock was eliminated there by fires. Red maple, yellow and black birch, white ash, and black cherry were common associates in both the hemlock-beech and beech-maple types, with scattered distribution in both.

Species Distribution

Perhaps the best data on relative abundance of the various species in the original forest are those obtained by Lutz (*1930b*) from examination of the original land-survey notes for an area that corresponds approximately to the present Allegheny National Forest. Although 32 species of trees were mentioned in those survey notes, relatively few of them made up the bulk of the stand. Beech and hemlock represented 58 percent; these two plus maple, birch, white pine, and chestnut represented 88 percent (table 1).

Crude estimates of frequency were also obtained from these data (table 1). Beech and hemlock were present on nearly all the survey lines, maple and birch on more than 80 percent of the lines, chestnut and white pine on about 60 percent of the lines. Most of the other species were encountered infrequently, suggesting that they probably occurred as solitary individuals or groups in the virgin forest.

There was little information about understory vegetation, except that laurel thickets were mentioned frequently in the notes. They were often referred to as "inextricable labyrinths".

The high frequency and low abundance of white pine, chestnut, and birch—and to a lesser extent maple—indicate that all these species were common, but that they rarely were a major component over sizable areas. Although white pine occurred in pure stands in some places, these must have represented a comparatively small proportion of the total forested area.

In many places, white pine also occurred as a minor component in other types, probably originating under a partial canopy after some

Table 1.—Original forest composition of Allegheny National Forest, in percent

Species	Abundance[a]	Frequency[a]
Beech	30.85	98.7
Hemlock	26.80	100.0
Sugar maple	13.04	81.5
Red maple	—	65.6
Birch	6.06	82.8
White pine	5.99	64.3
Chestnut	5.57	57.9
Laurel	3.92	52.2
Ash	1.04	31.2
Sycamore	.62	19.1
Oak	.57	15.9
Magnolia	.42	12.7
Sassafras	.42	6.4
Ostrya	.33	11.5
Hickory	.28	8.9
Yellow-poplar	.23	7.6
Basswood	.14	3.8
Witch-hazel	.10	4.4
Black cherry	.09	3.2
Amelanchier	.07	2.5
Carpinus	.07	2.5
Dogwood	.05	1.3
Alder	.02	.6

[a] Abundance was calculated as a percentage of the total number of trees counted as corner or witness trees or otherwise mentioned in the land survey. Frequency was calculated as the percentage of survey lines on which that species was mentioned. From Lutz (*1930b*).

minor disturbance that did not completely remove the overstory. Evidence for this sort of origin of the pine component of the hemlock-beech virgin forest at Heart's Content has been presented by Lutz and McComb (*1935*).

The abundance of white pine in presettlement forests has probably been overstated in many early accounts. This would be understandable in view of its occurrence in the valleys along transportation routes, and in view of its early importance in the lumber industry.

Plenty of Wildlife

A great variety of wildlife inhabited the forests of the Allegheny Plateau before settlement by the white man. Of the larger animals, deer, elk, bear, wolves, cougars, wildcats, and lynx were all present. Some authors suggest that there were also moose and bison, but this has never been substantiated (*Clepper 1931, Doutt et al. 1966, Simpson 1890-1944*).

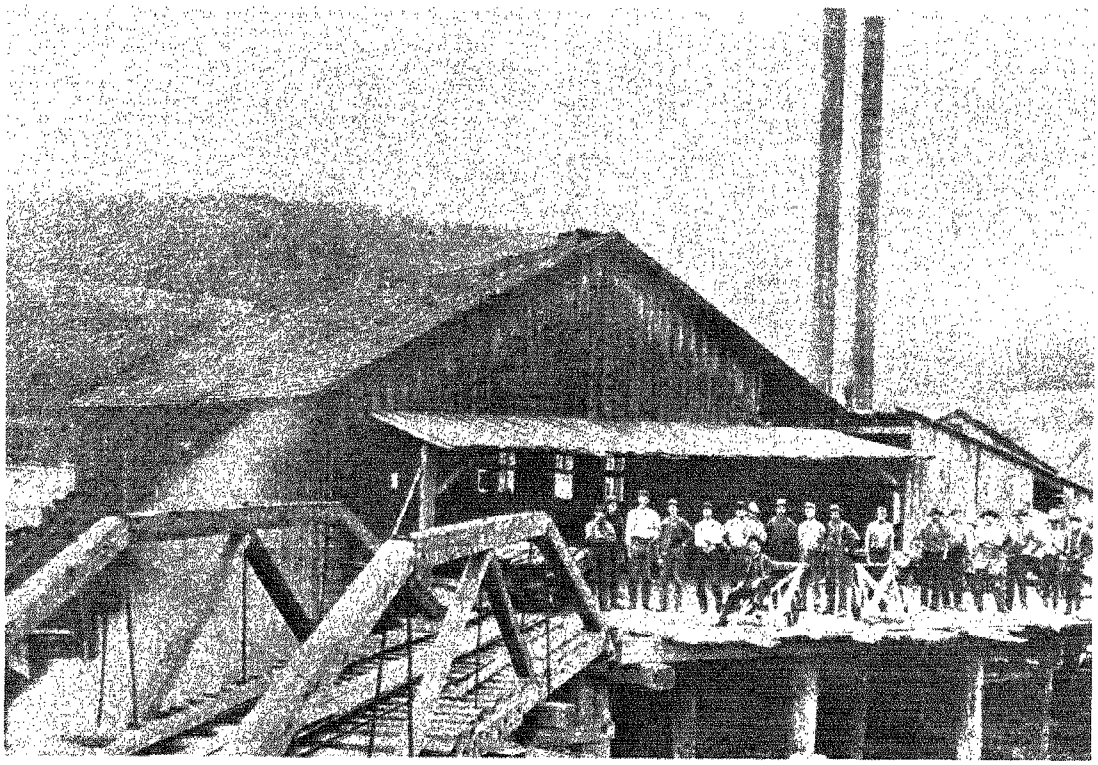
White-tailed deer were common, but not abundant during this time. Vast stretches of unbroken timber limited food, and predators helped to keep populations in check. Deer were probably more numerous in northwestern Pennsylvania than in eastern Canada, northern New England, and northern New York, where deep winter snows provided an additional handicap.

But deer were less numerous here than they were throughout the oak forests of the Ohio and Mississippi River valleys where plentiful acorns and more moderate winters provided better conditions (*Maynard et al. 1935, Taylor 1956*).

Deer provided an important source of meat and clothing for the Indians, and Indian activities (hunting, agricultural clearings, fires) probably had some effect on deer populations. However, their effect was undoubtedly small in comparison with that resulting from later settlement by Europeans.

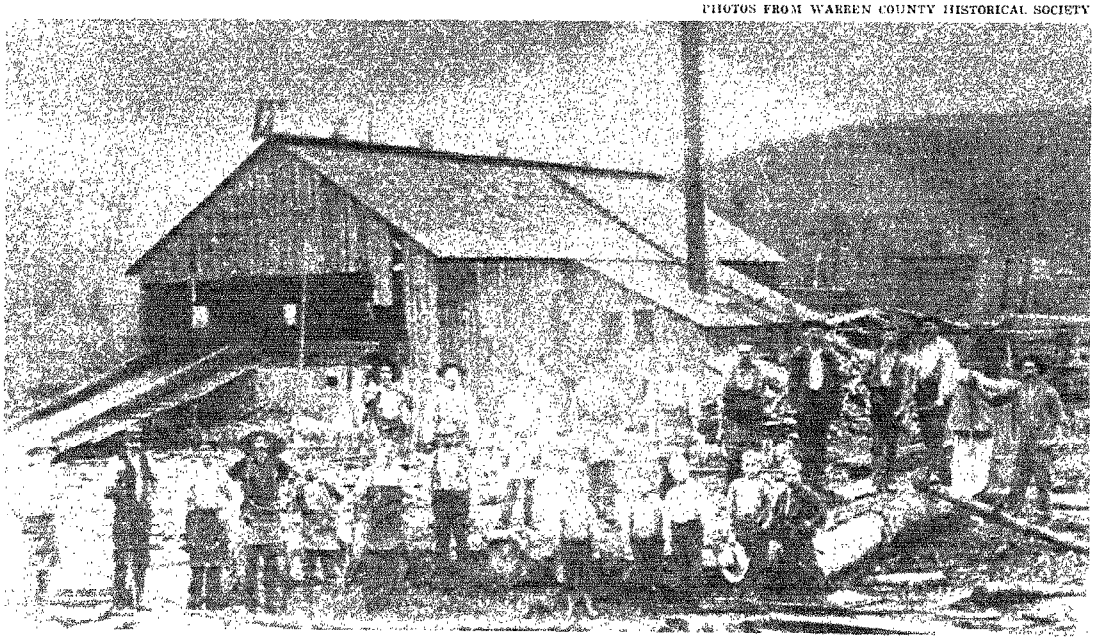
Even the earliest settlers cut timber for market. It took muscle and horsepower to log in those days.

PHOTO FROM CHARLES CATLIN COLLECTION



Early steam-powered circular sawmills in Warren County; (above) Bucher's Mill at the present site of Chapman Dam State Park, and (below) Wood's Mill at the present site of the Farnsworth Fish Hatchery. The first water-powered sawmill in the county was established in 1800.

PHOTOS FROM WARREN COUNTY HISTORICAL SOCIETY



Settlement and Development

Several early explorers apparently passed down the Allegheny River during the 1600s and early 1700s, but the first fully documented exploration in the region that is now the Allegheny National Forest was that of Captain Bienville de Celeron, who came down Conewango Creek to the Allegheny River with a party of 215 Frenchmen and 55 Indians in 1749. Nearly 40 years passed before Fort Franklin was garrisoned in Warren County in 1787, and it was not until 1796-97 that the first white settlers arrived (*Kussart 1938, Schenck and Rann 1887*).

Settlement proceeded slowly during the next 10 or 20 years. The three major routes of travel across the Alleghenies from the East Coast to the western frontier (then in Ohio) were all to the south, the northernmost route passing through what is now Kittanning.

Although the Allegheny River was also an important travel route, serving primarily as a way for settlers crossing from New York State to reach the Ohio Valley, few of these settlers stopped on the Allegheny Plateau. The rough topography and climate prevented heavy settlement for farming (*Mason 1936*). As a result, the population of Warren County was only 26 in 1810 (*Schenck and Rann 1887*), and that of McKean County was only 142 in that same year (*Bennett 1969*).

Early settlers cleared the forests for their cabins and for a limited amount of agriculture. To the crops of corn, beans, pumpkins, squash, and other vegetables they got from the Indians, they added wheat and oats, and later sheep for both meat and clothing (*Mason 1936*).

Even the earliest settlers did some timber cutting for market: the first sawmill in Warren County was established in 1880 (*Illick 1922*). This was a water-powered mill, with an overshot wheel, built in conjunction with a grist mill. About 30,000 feet of pine timbers from this mill were rafted to Pittsburgh in 1801; this was probably the first lumber raft to be sent down the Allegheny (*Kussart 1938*).

Rafting on the Allegheny

The Allegheny River was declared a public thoroughfare in 1807, primarily for rafting of lumber, but also for freight on flatboats. The first roads were built through the valleys about 1810 (*Mason 1936*). With the roads and river transport came more people. Warren County was organized as an official entity in 1819, at which time its population had grown to nearly 2,000 (*Schenck and Rann 1887*).

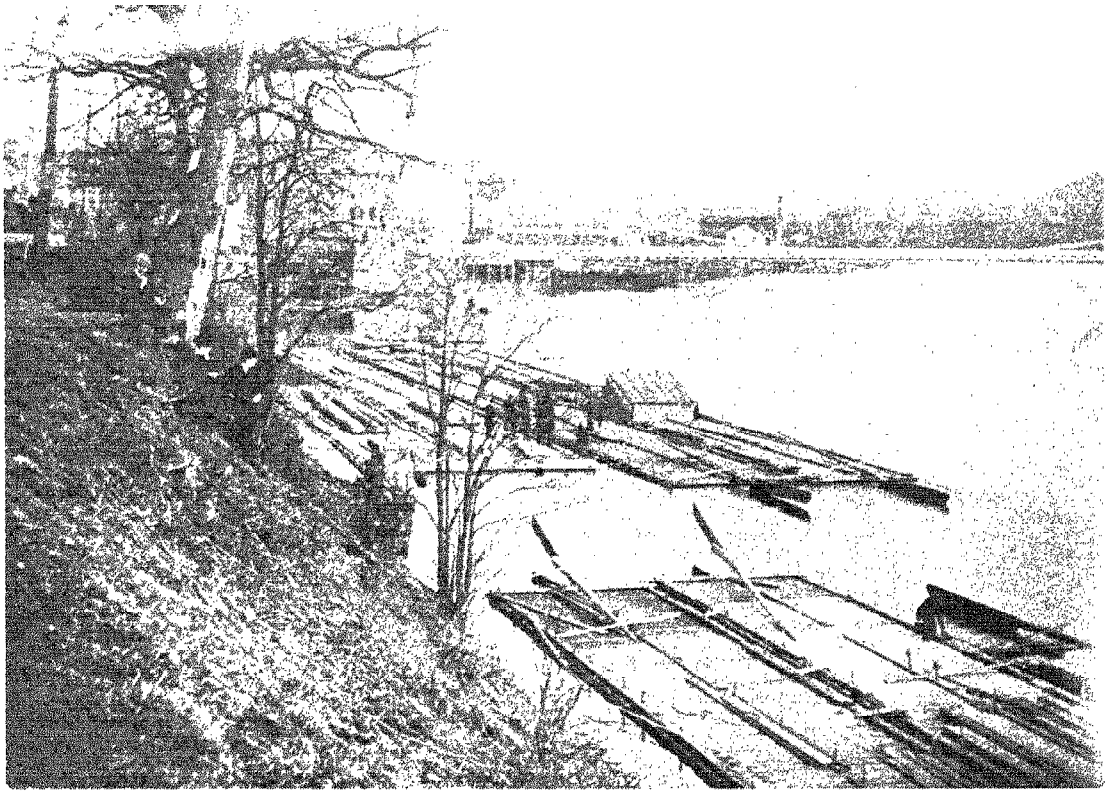
The first steamboat cruised on the upper Allegheny River in 1830, by which time the population of Warren County had reached 4,697. Although steamboat service was always sporadic (upper parts of the river were passable only during high water; so boats often made only one or two rounds trips a season), it was a great improvement over hand-poled or horse-drawn keel boats, which often required 10 to 12 days to make the journey from Pittsburgh with their limited cargos. By 1840, the population of Warren County had doubled again, to 9,278 (*Schenck and Rann 1887*).

From a modest beginning in 1801, lumbering and rafting increased rapidly. Pine from the Brokenstraw, Conewango, Kinzua, Tionesta, and Allegheny Valleys was sawed on the many water-powered mills that sprang up after 1820.

About 1820, it was estimated that there were 15 sawmills on Brokenstraw Creek, producing 9 million feet annually; 30 sawmills on Conewango Creek, producing 18 million feet annually (*Kussart 1938*); and 21 sawmills on Tionesta Creek (*Lutz 1930b*).

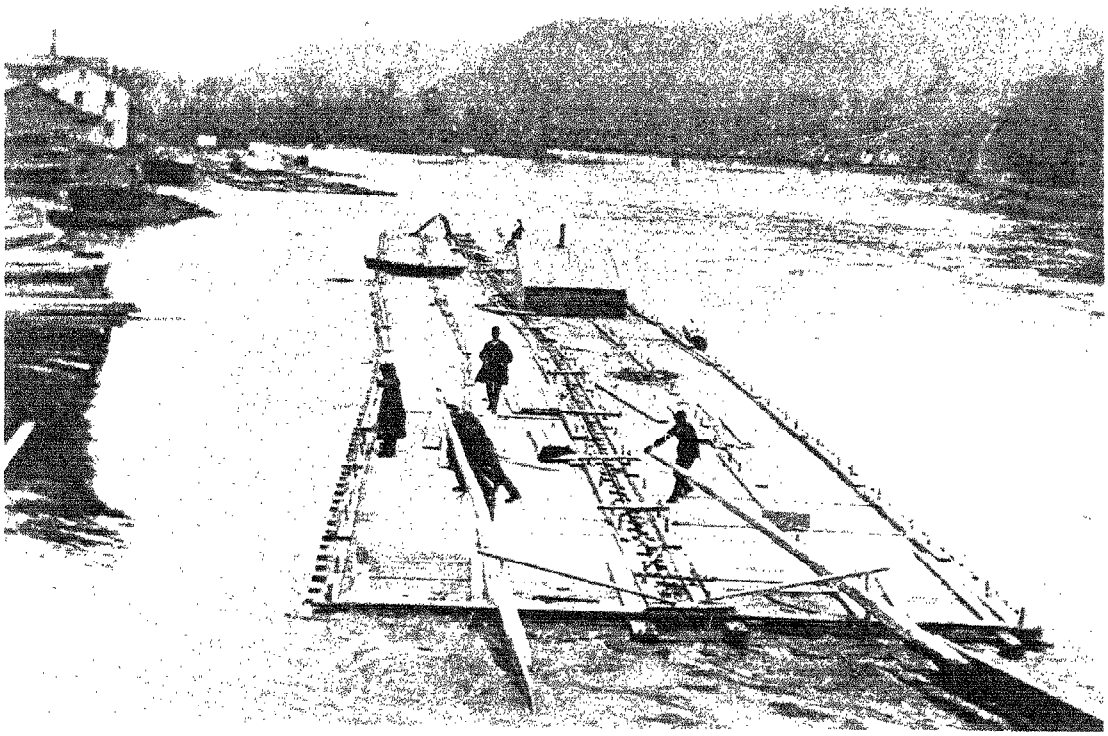
By 1837, there were an estimated 100 sawmills in Warren County, producing 45 million feet annually (*Kussart 1938*). This latter figure suggests that somewhere between 1,000 and, 2,000 acres of pine timber must have been harvested in Warren County each year during this period. Timber harvesting was of considerable importance even in these early times.

Although there is no way of knowing, these lumber production figures may be somewhat exaggerated. It was common practice in those days to speak of a mill in terms of its rated capacity—actual cut was usually much less than this. In view of the population in 1820, the quoted production figures seem high.



Rafting became big business in the early 1800s. Great rafts like these at Warren carried Allegheny Plateau lumber to Pittsburgh, to Cincinnati, and even to New Orleans.

PHOTOS FROM WARREN COUNTY HISTORICAL SOCIETY



Records of the amount of lumber reaching Pittsburgh via Allegheny River rafts provide another crude index of the lumber industry on the upper river. From an average of about 3 million feet annually before 1810, the amount of lumber rafted to Pittsburgh increased to 7 million in 1812, and to 20 or 30 million in 1860 (*Kussart 1938*). In 1840, common pine boards sold for $7 per thousand while, clear boards brought $14 per thousand.

Early accounts of lumber rafts provided a vivid picture of their size and importance. One writer suggested that the principal streams were filled with rafts of lumber each spring, waiting for high water to carry them to Pittsburgh or Cincinnati or even New Orleans.

At Warren, groups of 30 rafts were united into a fleet, each propelled by six oars, with one man per oar (*Mason 1936*). Some of these rafts were 60 to 70 feet wide and 250 to 300 feet long (*Kussart 1938*). The largest single raft was said to have contained 1,500,000 feet of lumber and to have covered over 2 acres of water surface (*Schenck and Rann 1887*).

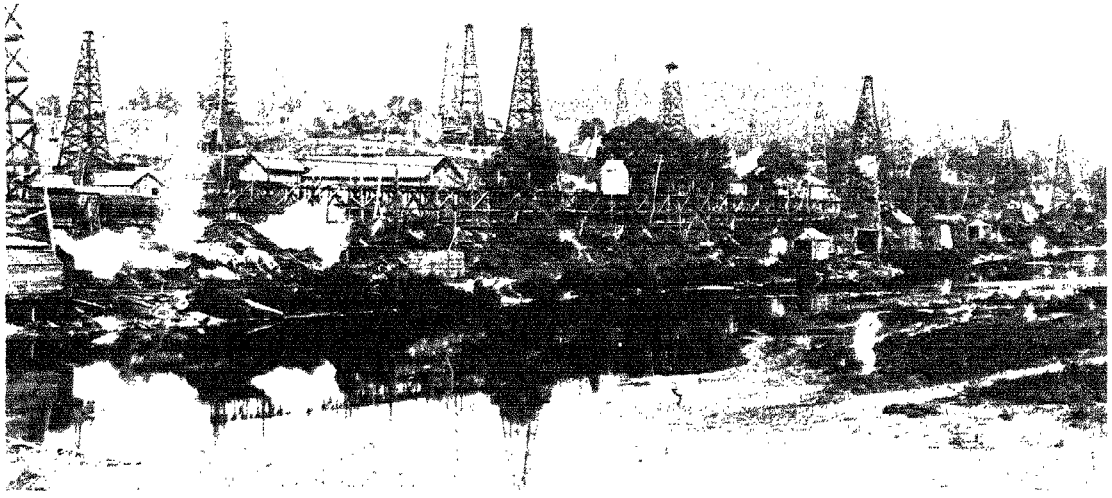
In spite of lumbering operations, the Allegheny Plateau remained a heavily forested inaccessible frontier area through 1850 or 1860. The effect of lumbering was still noticeable only along the larger streams; vast amounts of pine remained untouched along the smaller streams (*Kussart 1938*). And those areas somewhat removed from the Allegheny River itself were much slower to develop.

For example, Warren County was settled about 1800 and McKean County about 1804, but Elk and Forest Counties were not formed until 1843 and 1848. The first settlers in Warren Township came before 1800, but Tionesta was not settled until 1816, and Oil City not until 1824 (*Kussart 1938*).

Industrial Development

However, by 1860 the pioneer character of the Plateau region had begun to give way to industrial development. Steam provided the power for most of this industrialization, in the form of steam railroads, steam-powered saw-

Industrialization came to the Allegheny Plateau in mid-century. The first railroad reached Warren in 1859, and the first oil well was drilled the same year. This is how Warren looked at the peak of the oil boom.



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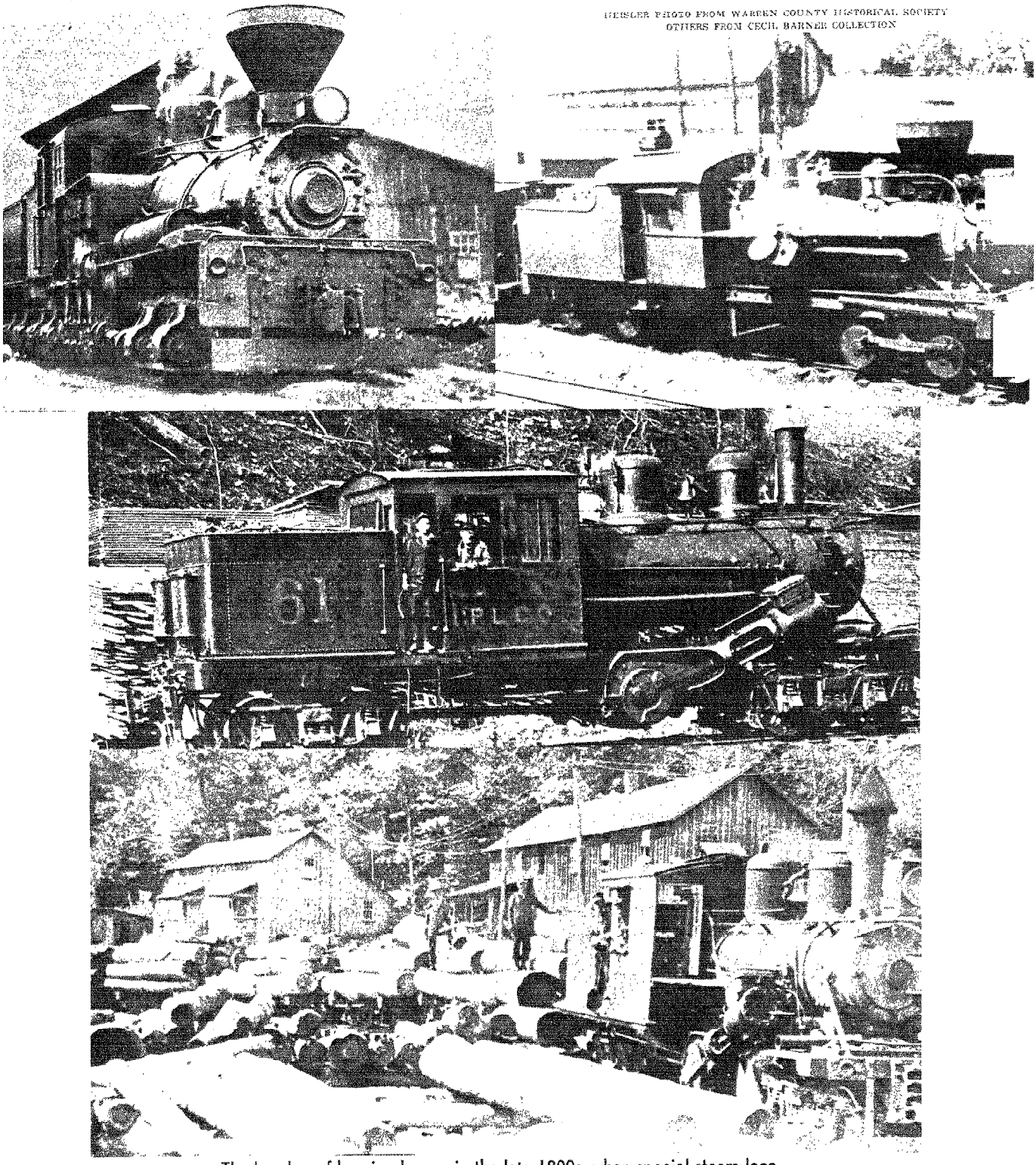

The heyday of logging began in the late 1800s, when special steam locomotives were developed for logging. These geared locomotives were: the Shay (upper left), the Heisler (upper right) and the Climax (center and bottom).

mills, steam log loaders, and other similar equipment. The first railroad was completed to Warren in 1859, and two others were opened within the next 10 years.

The first oil well was drilled in 1859, and the Tidioute oil field was opened in 1860. By 1880-90 the oil industry had reached peak production of over 30 million barrels annually (*Schenck and Rann 1887*).

Tanneries appeared in the 1850s, and circular sawmills began to replace the water mills during the 1860s (*Bennett 1969*). Huge bandsaw mills with rated capacities of 30 to 40 million feet annually (actual cut about 10 to 20 million feet annually) appeared after 1870 or 1880.

Locomotives especially designed for logging railroads (Shay, Climax, and Heisler locomotives) came into common use after 1885, and railroads were soon pushed up every drainage to tap the timber resources there. Chemical-wood plants began to appear about 1890.

The iron industry also influenced industrialization to a large extent. In 1849, for example, there were 504 blast furnaces in Pennsylvania using charcoal, of which one-third were in western Pennsylvania. Although charcoal was replaced by anthracite about 1855, anthracite was itself replaced by bituminous coal coke around 1875. This resulted in an 80-fold increase in bituminous coal production between 1847 and 1900, creating new drains on the forests for pit props, mine ties, and timbers (*Spring 1906*). Although the coal-mining and iron industries were concentrated south of the Allegheny Plateau region, both activities had some impact on the Allegheny forests.

Early Cutting Was Patchy

As populations increased and industrial demands for land and raw materials expanded, the intensity of forest cutting accelerated. Pine continued to be the major species cut, but hemlock was also being felled after about 1850. Hemlock bark was widely used for tanning leather; and as pine began to become scarce, the amount of hemlock sawed into lumber increased dramatically.

Figures on pine and hemlock logs passing through the big boom at Williamsport provide some measure of the changes that occurred. In 1875, ten times as much pine passed through the boom as hemlock (190 vs. 20 million feet); but by 1893 the figures were nearly reversed: 33 million feet of pine vs. 187 million feet of hemlock (*Rothrock and Shunk 1895*).

Up until about 1880, forest cutting on the Allegheny Plateau was characterized by patchiness—small stands of pine here and there were harvested, scattered groups of pine throughout the remainder of the area, and some small proportion of the hemlock along the major drainages.

But the major portion of the virgin forest was still intact, although some cutting had occurred throughout. Most of the heavy cutting had been restricted to the stream valleys by the necessity of water transport for the logs.

The Clearcutting Era

After 1880 to 1890, however, the development of logging railroads with their specialized locomotives and other equipment provided means of transporting logs from even the most rugged areas. There was no longer any need to rely on access to streams; railroads could reach anywhere, and they provided supplies of logs year-round.

The big band mills, too, made possible the large operations necessary to finance the building of railroads into the timber; and the chemical-wood industry provided a market for virtually every size and species of tree growing on the Plateau. It was no longer necessary to search out small pockets of pine, or to cut the hemlock and leave the hardwoods.

Nearly everything was merchantable: hemlock bark for tanning; logs for construction lumber, railroad ties, shingles, barrel staves, lath, furniture, tool handles, and other products; bolts for chemical wood to make charcoal, acetic acid, wood alcohol, and other distillation products; scrap pieces for clothespins and other speciality products; and slabs, edgings, and sawdust for fuel for homes and power.

Between 1890 and 1920, the virgin and partially cut forests were almost completely clearcut in what must have been the highest degree of forest utilization that the world has ever seen in any commercial lumbering area (*Horst and Smith 1969, Taber et al. 1970-72*).

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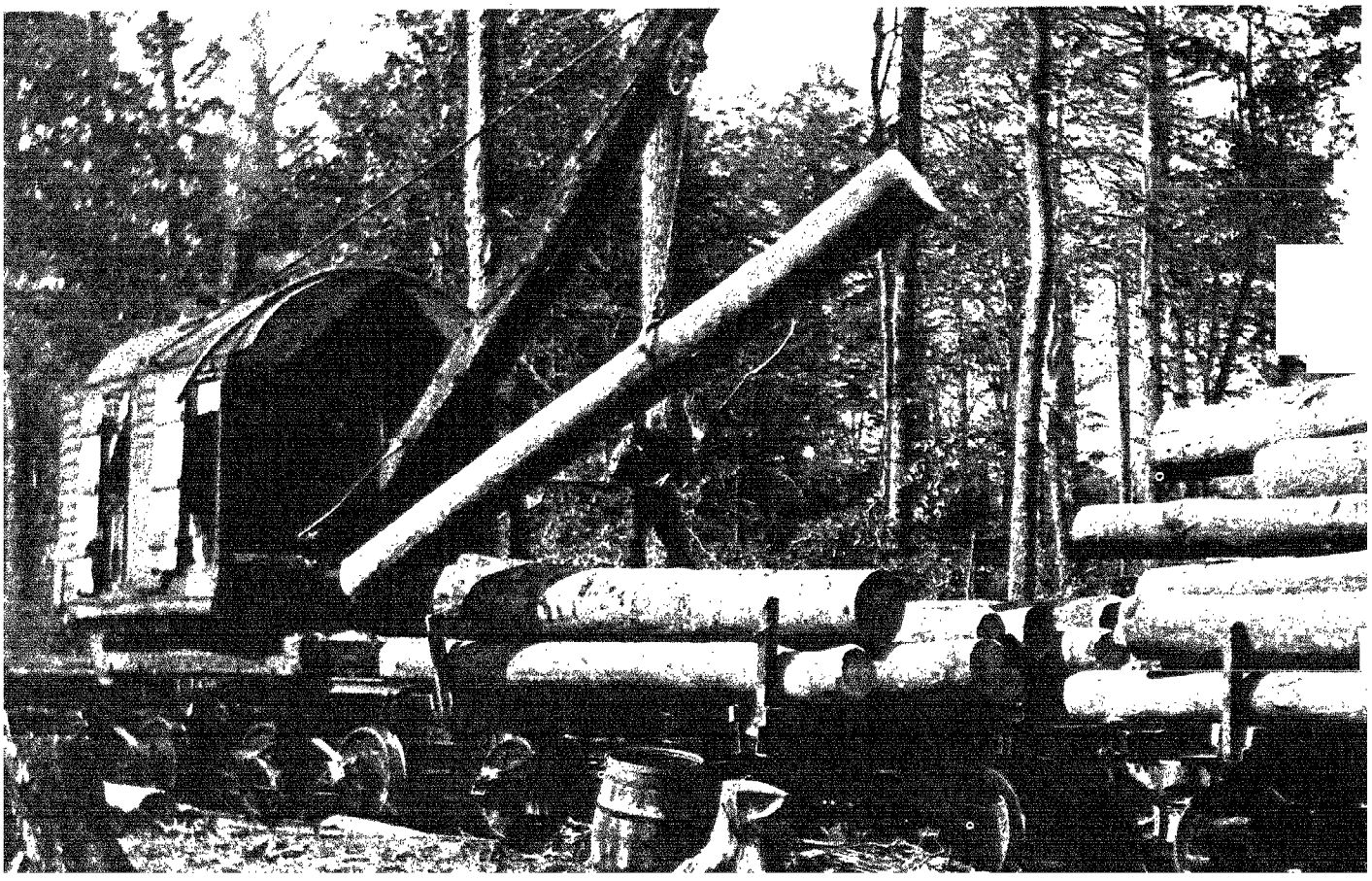
Railroads could reach up into any valley to bring the logs out.

A Barnhart log loader at work in the woods on the Goodyear Lumber Company operations, near Norwich about 1912.

PHOTO FROM CHARLES CATLIN COLLECTION



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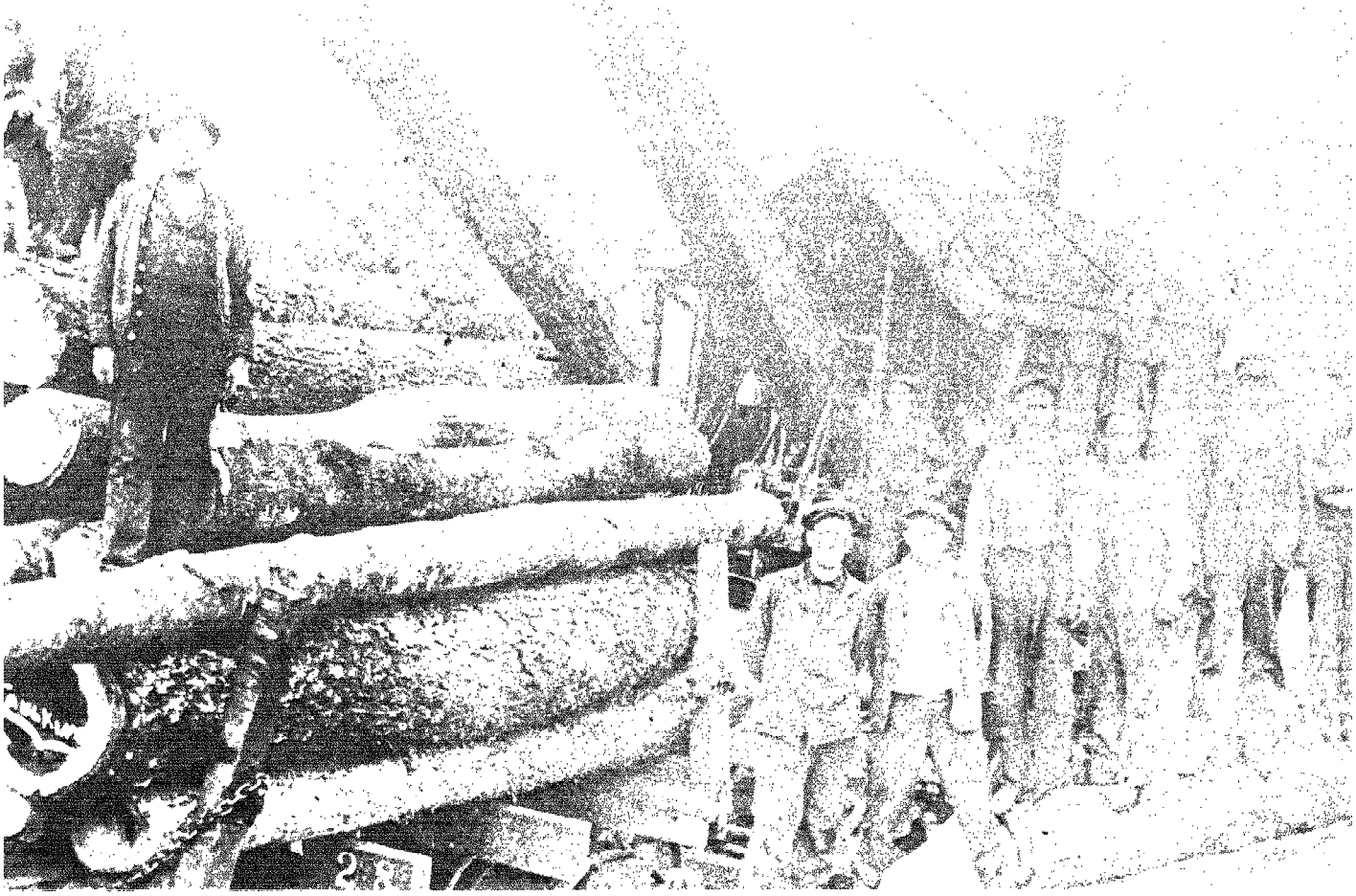
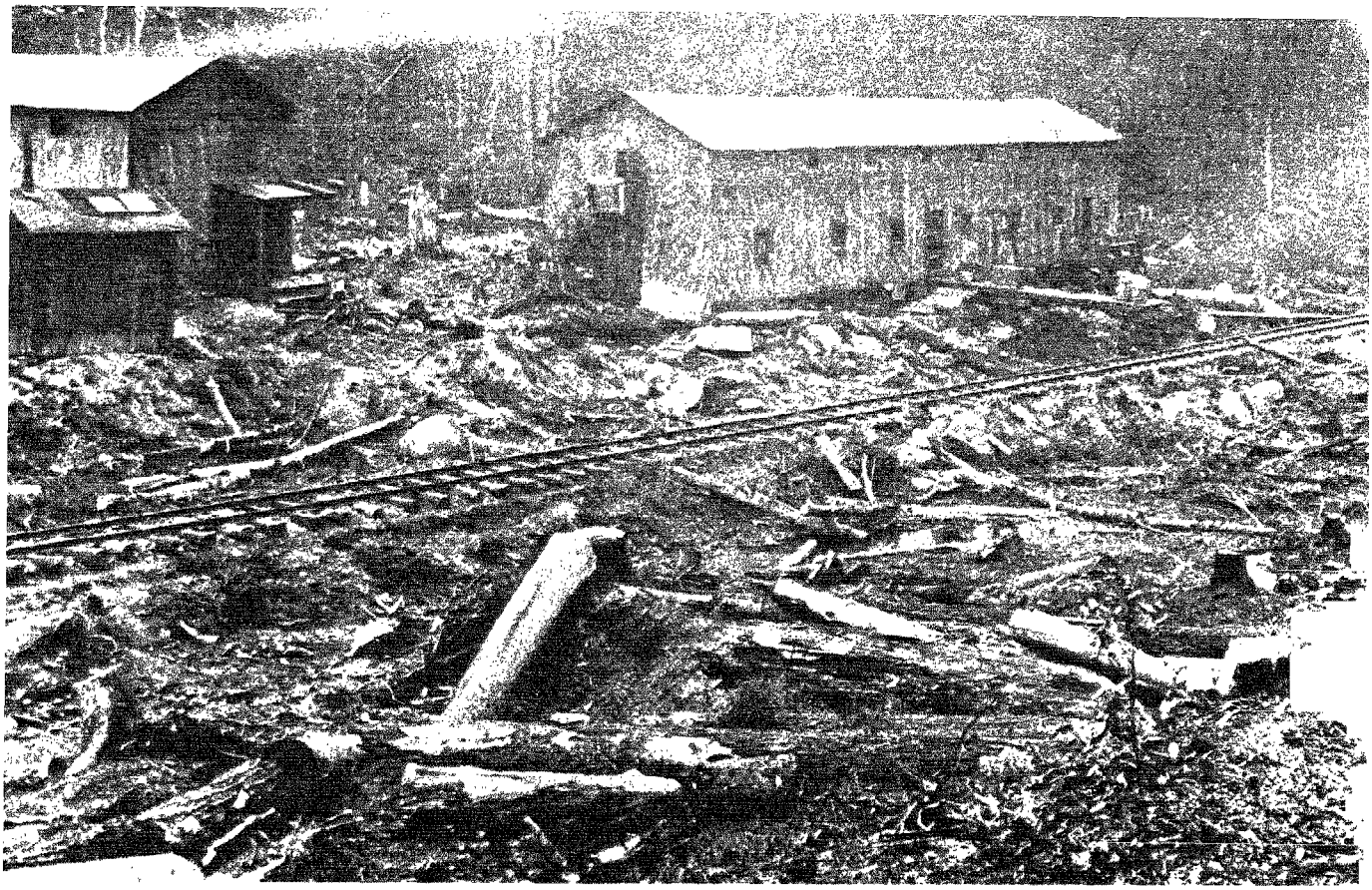
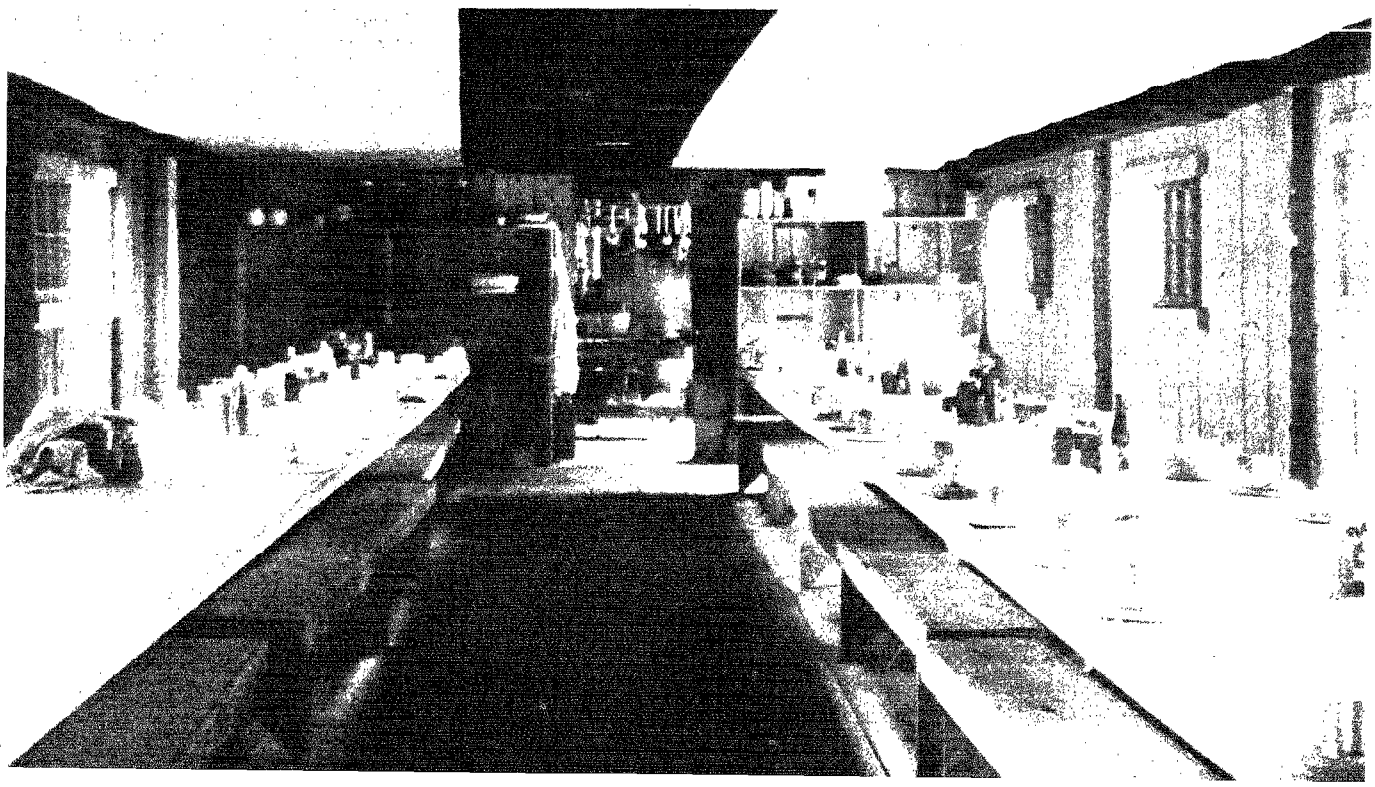


A loader crew of the Central Pennsylvania Lumber Company stand by to have their picture taken, near Masten in Lycoming County.



Potter's logging camp on the east branch of Tionesta Creek in 1933.

Mess hall of Potter's logging camp.



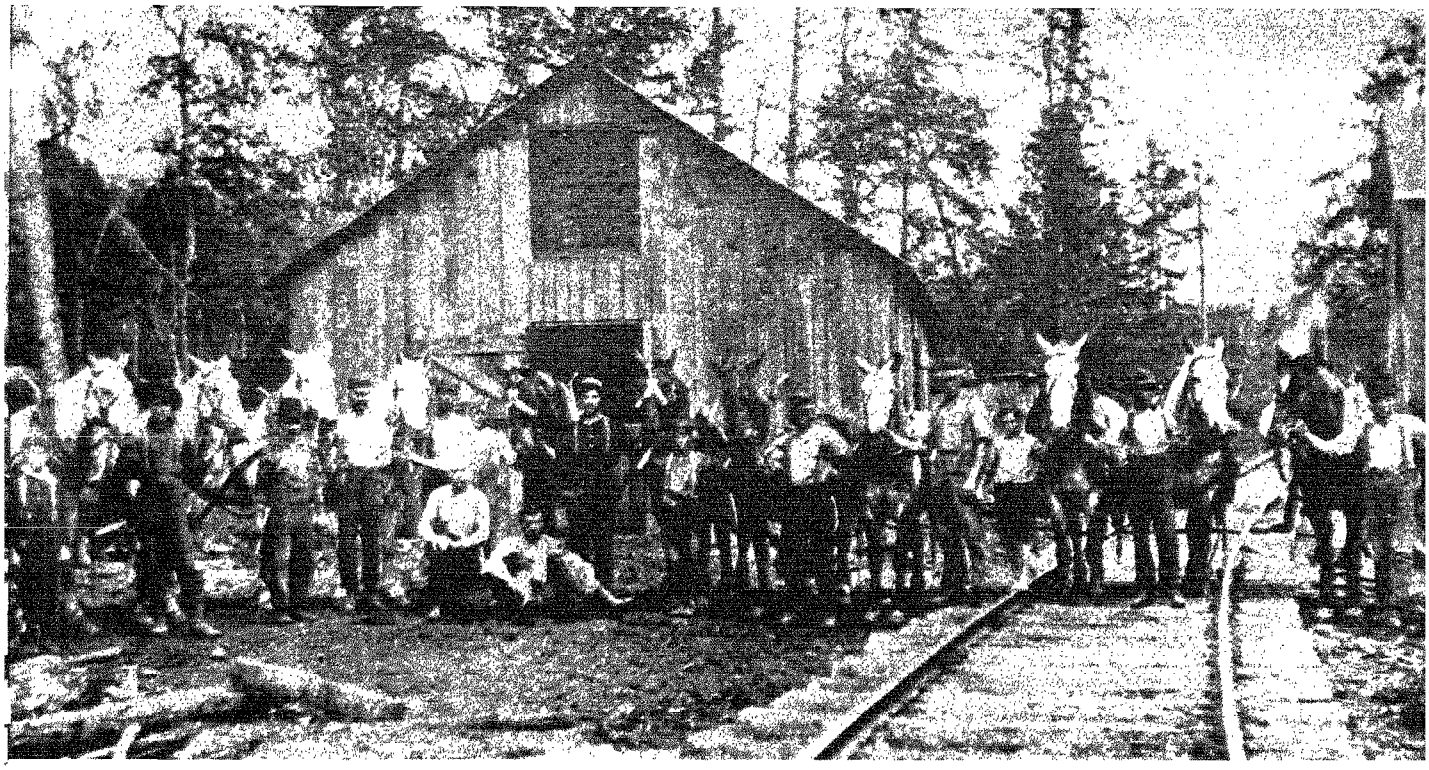
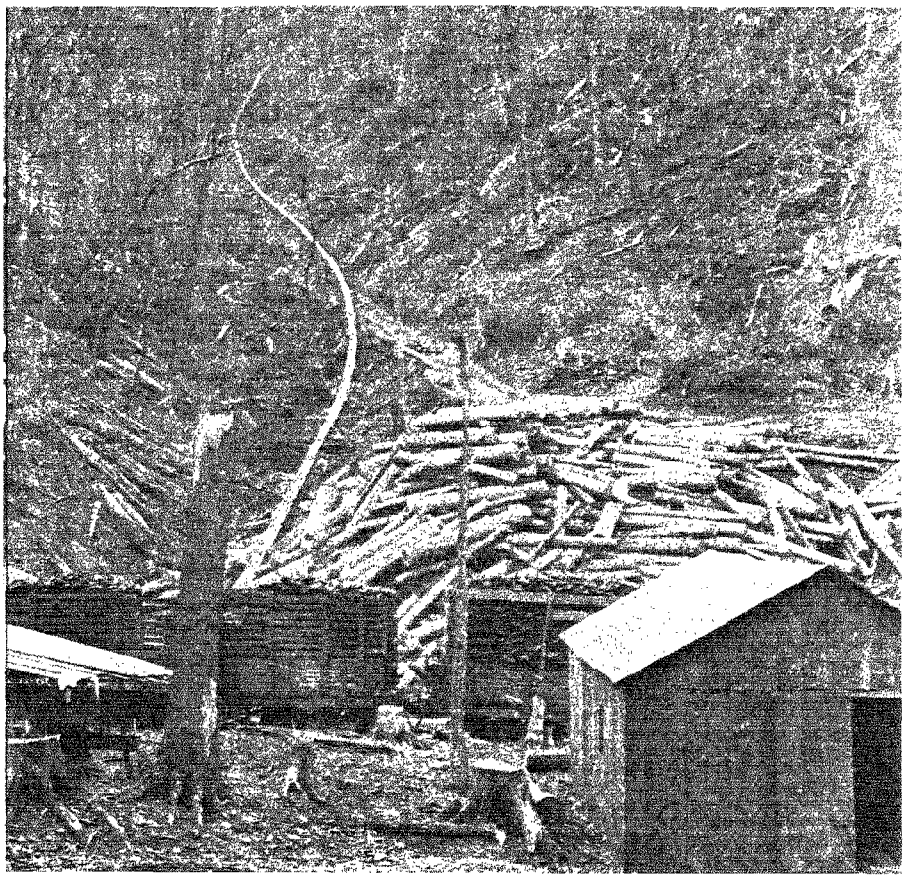


PHOTO FROM JAMES SCHMONSKY COLLECTION

Though the logging railroad opened the way into the woods, it still took a lot of manpower and horsepower to fell the trees and get the logs to the landing. A scene at a logging camp near Cherry Grove in Warren County.

PHOTO FROM CHARLES CATLIN COLLECTION



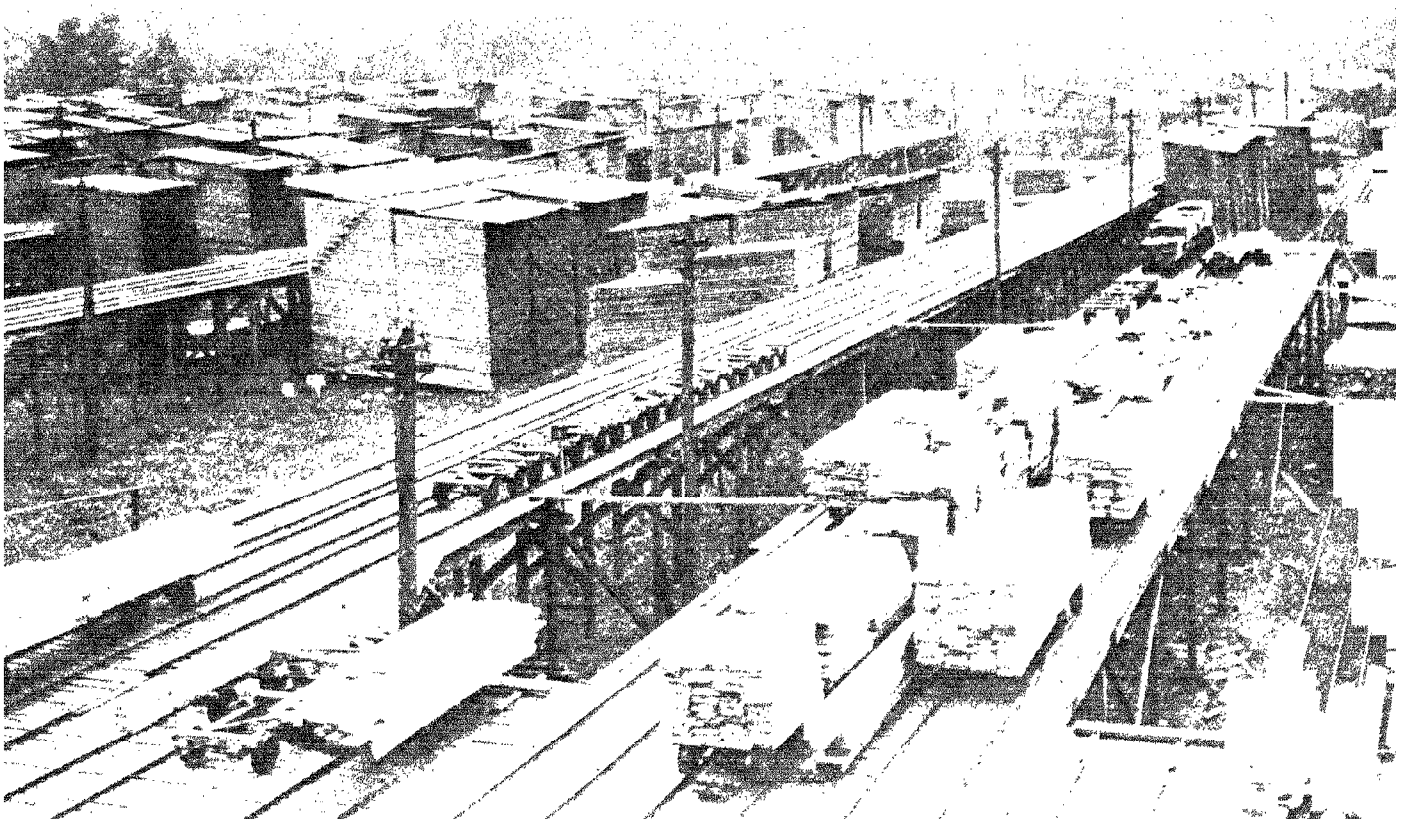
A log and bark landing on the Potato Creek Railroad of the Goodyear Lumber Company about 1912. Notice the chute for sliding hemlock bark down the hillside.

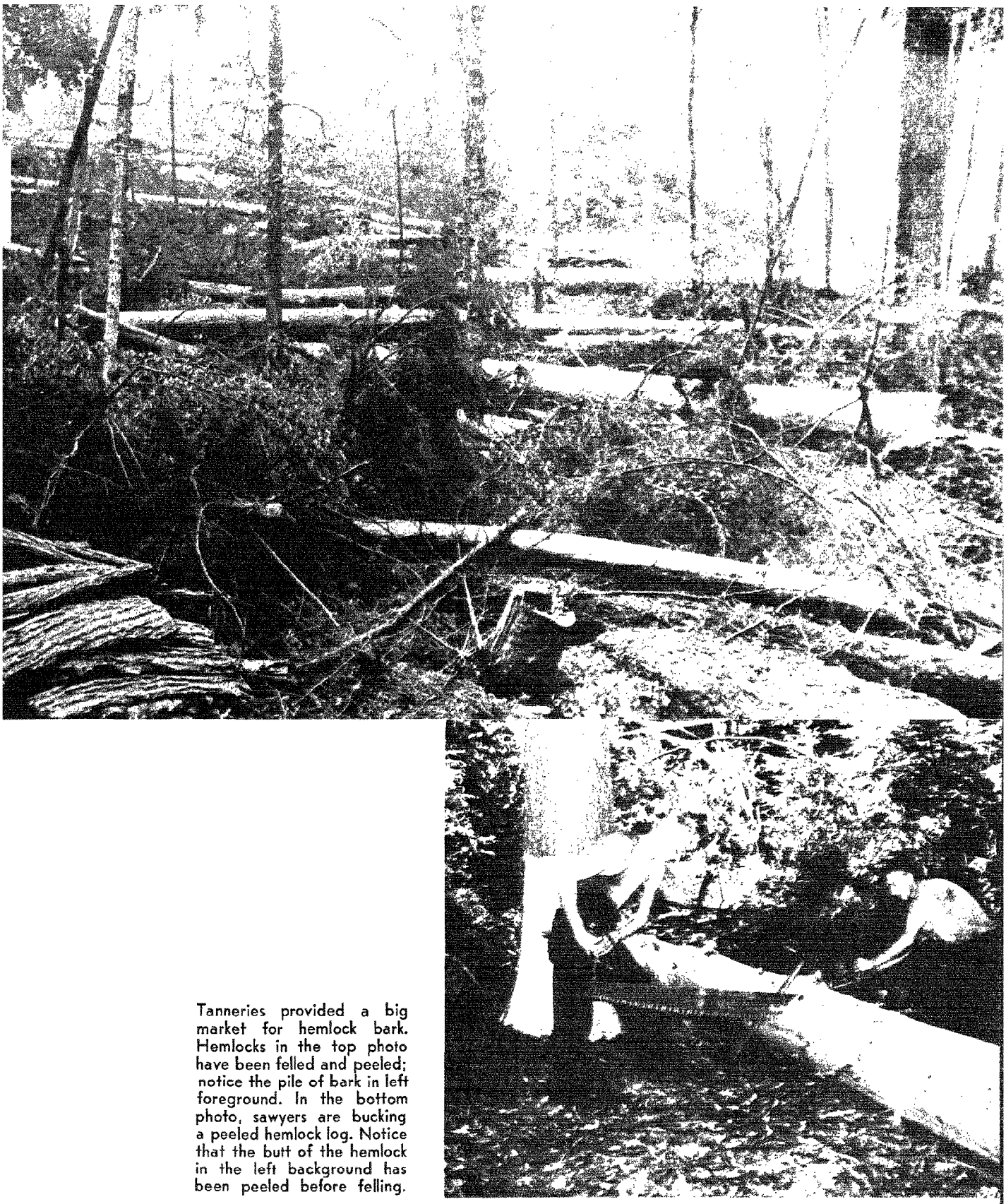
And didn't they bring in the logs!

LOWER PHOTO FROM COLLECTION OF DELBERT SILVES

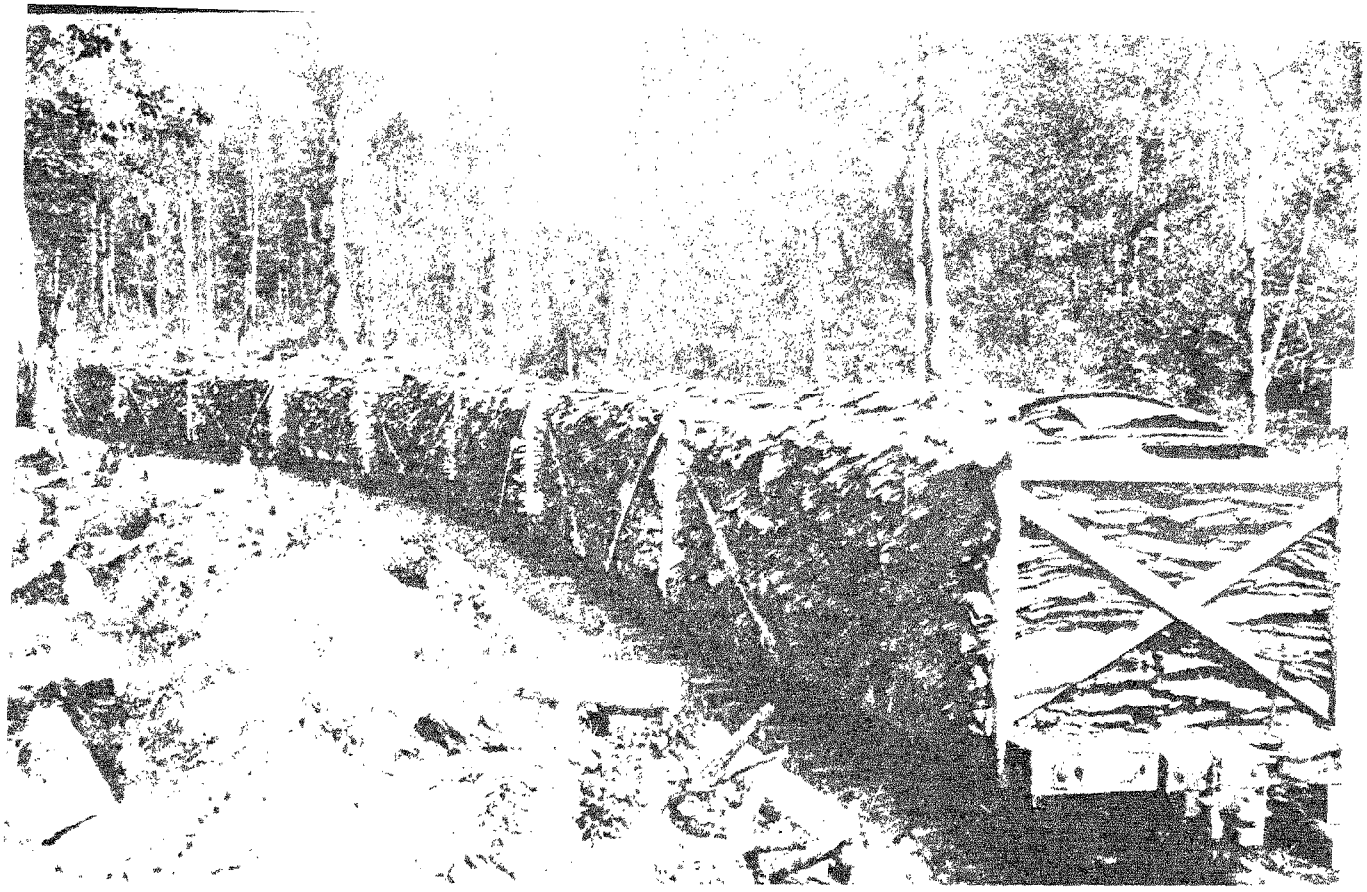
Trainload by trainload, the logs move toward the mill.

Great band sawmills sprang up after about 1890, to produce billions of board feet of lumber. Central Pennsylvania Lumber Company sawmill at Sheffield in Warren County.



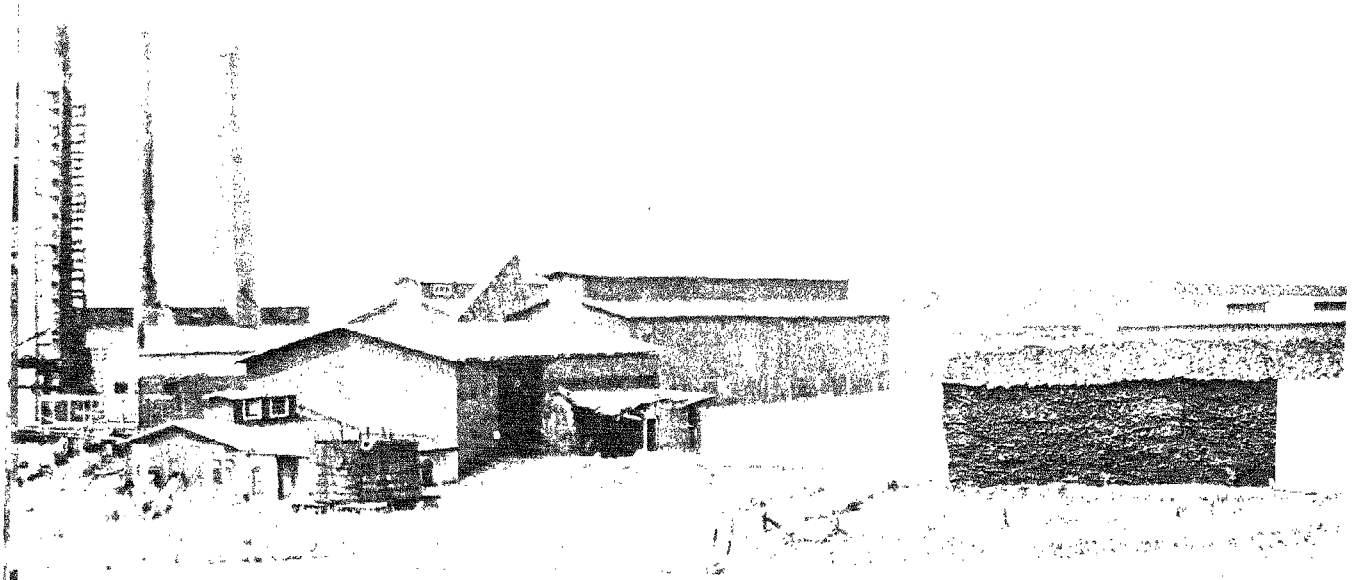


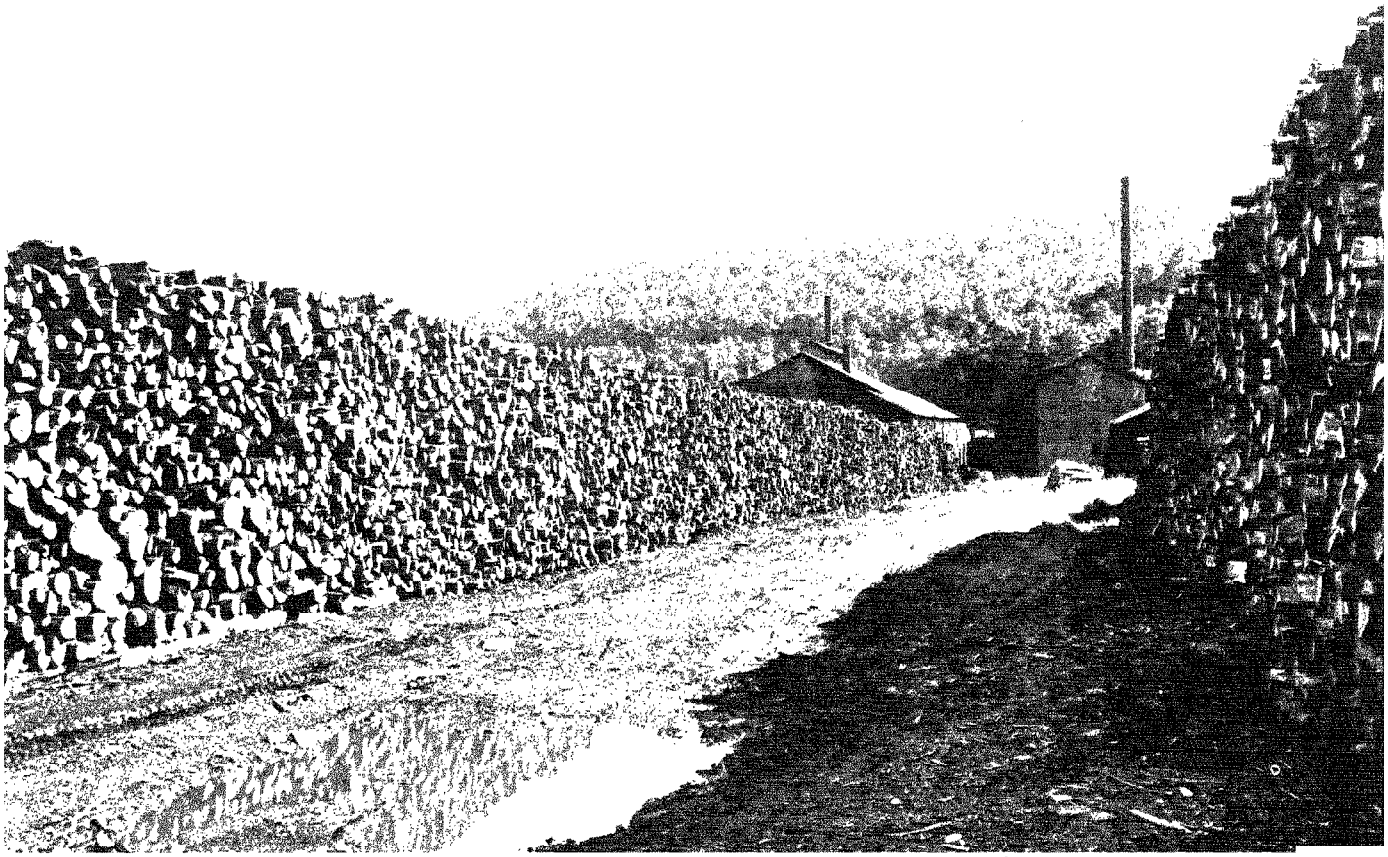
Tanneries provided a big market for hemlock bark. Hemlocks in the top photo have been felled and peeled; notice the pile of bark in left foreground. In the bottom photo, sawyers are bucking a peeled hemlock log. Notice that the butt of the hemlock in the left background has been peeled before felling.



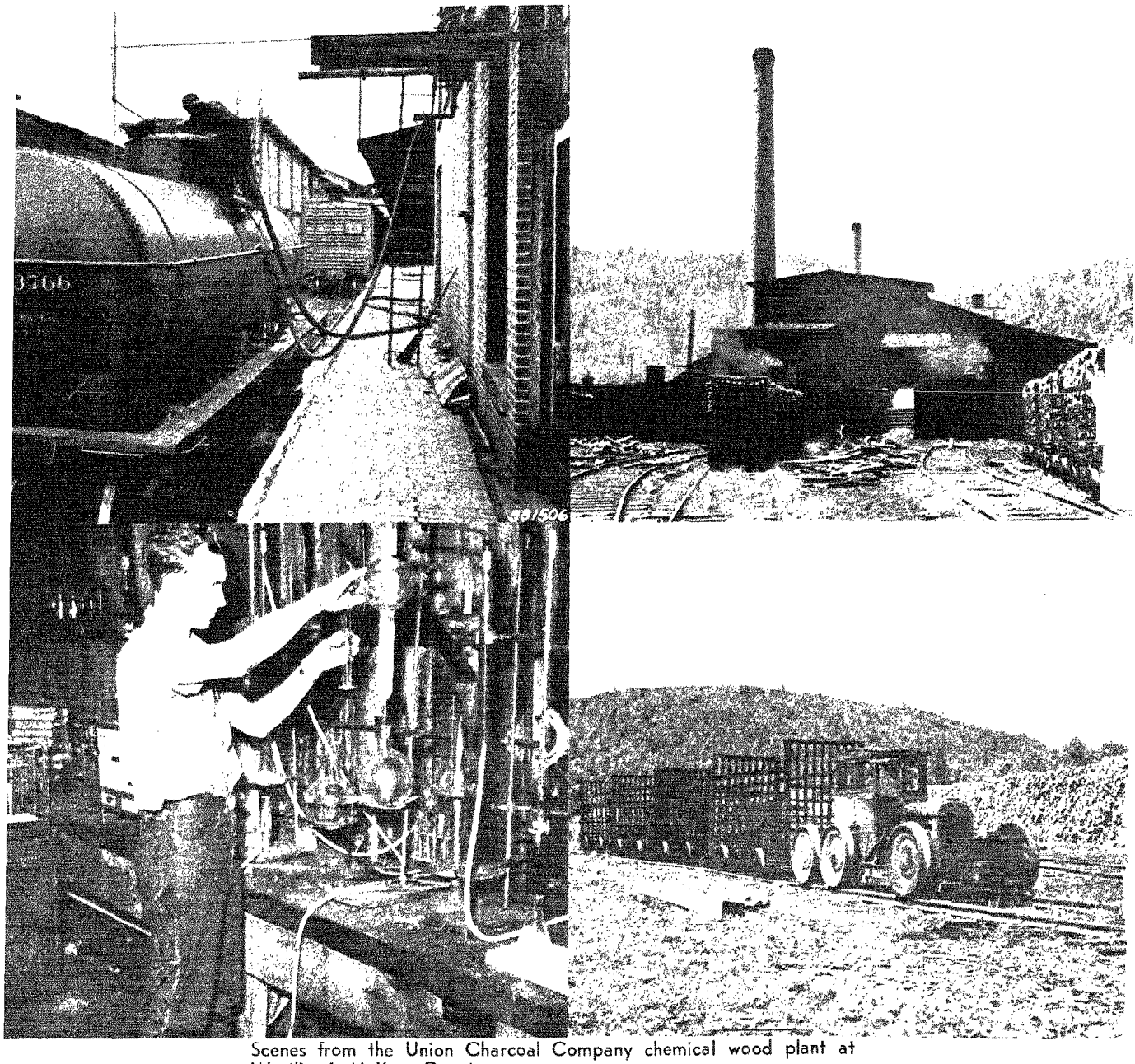
A trainload of hemlock tanbark on Central Pennsylvania Lumber Company operations in McKean County.

Elk Tanning Company Plant in Wilcox. Notice large pile of hemlock bark in right center.





Bolts of chemical wood used for making charcoal, acetic acid, alcohol, and other distillation products at the Otto Chemical Company in Sergeant, McKean County.



Scenes from the Union Charcoal Company chemical wood plant at Westline in McKean County.

Market for Deer

Lumber was not the only forest product used during this era: deer were hunted extensively. The extent of this hunting pressure during early times is probably not fully appreciated today. There were no closed seasons or restrictions on the number that could be taken. Professional hunters shot deer for the market, using dogs and salt licks to increase their efficiency. The demand for deer meat for hotels, lumber camps, and city markets was extreme.

For example, in Michigan, where extensive cutting was also taking place, more than 100,000 deer were sold in the markets in 1880 (*Taylor 1956*). The situation in Pennsylvania was probably similar.

Effect of Lumbering on Seedling Regeneration

As we have seen, the forests of the Allegheny Plateau were subjected to two distinctly different types of cutting. From 1800 to 1890, lumbering involved scattered, sporadic harvesting of the larger trees of selected species. The vast majority of trees cut during this period were white pine, although hemlock and even some of the better hardwoods were cut toward the end of the period.

Then, from about 1890 to 1920 (and in some areas up to 1930), the areas that had been partially cut, and areas that had never been cut, were completely cleared. Most of the Allegheny Plateau was clearcut during that

The slash left in logging operations provided plenty of fuel for fires, particularly in areas where coniferous trees were abundant.

Smoke from the fire at Bear Creek in the Owl's Nest area of Elk County, in May 1926.

30- to 40-year period, and the present forests originated at that time.

Forest fires were extremely common during this latter era in areas that had originally contained conifers, and fires had a major effect on the present forest areas. In 1908, a million acres of forest land were burned in Pennsylvania (*Banks 1960*), as opposed to a current average of less than 8,000 acres (7,776 acres average in 1970-72).

Heavy cutting tends to favor hardwoods, since small hardwood seedlings that often exist beneath a forest canopy (advance seedlings) have a head start on new pine seedlings and can outgrow any hemlock advance seedlings. In addition, the frequent and repeated fires are much more damaging to coniferous seedlings than to hardwood seedlings, because the latter have the ability to resprout.

Thus fires probably were a major factor in the virtual elimination of white pine and hemlock in the Allegheny forests (*Illick and Frontz 1928, Bennett 1969*).

The massive amounts of coniferous slash provided ideal conditions for widespread and intense fires. Some fires burned in hemlock slashings for weeks at a time during the 1895-1930 period (*Mason 1936*). Repeated or se-

vere fires also tended to reduce the proportions of sugar maple, beech, and other typical hardwoods, and to increase species such as aspen, pin cherry, bracken fern, goldenrod, blackberry, sedges, grasses, and honeysuckles.

In some places, fires burned intensely enough to remove all humus, exposing the clay soil and creating some of the numerous open-areas that are still present on the Plateau, such as the Owl's Nest area (*Stotz 1957, Hough 1958*).

However, if fires were kept out or were not too severe, the second-growth stands that followed clearcutting were very acceptable. Many had produced 1 cord per acre per year by age 30 (*Elliott 1927, Illick and Frontz 1928*). They developed into the well-stocked pole stands noted by Ostrom (*1938*) and Hough and Forbes (*1943*), and are plainly evident today in the many small sawtimber stands of excellent species composition–stands dominated by black cherry, red maple, sugar maple, and white ash.

A scene today from the area burned in the Mill Creek fire of 1925; not much here but a few scattered trees and a savannah-type ground cover of bracken fern, goldenrod, aster, and grasses.

Protecting the Deer

By 1890, market hunting had made deer so scarce that they were rarely seen in their native habitat, and such sightings as did occur rated front page coverage in the local newspaper (*Clepper 1931*).

However, public concern for deer eventually led to an increase in deer populations. Pennsylvania appointed a game commission in 1896. Salt licks and dogs were forbidden for deer hunting in 1897, and market hunting was prohibited after about 1900. Game refuges were established beginning in 1905, and in 1906 deer were imported from other states to restock depleted areas. Perhaps most important of all, beginning in 1907, hunting was restricted to bucks (*McCain 1941, Leopold 1943, Roberts 1962*).

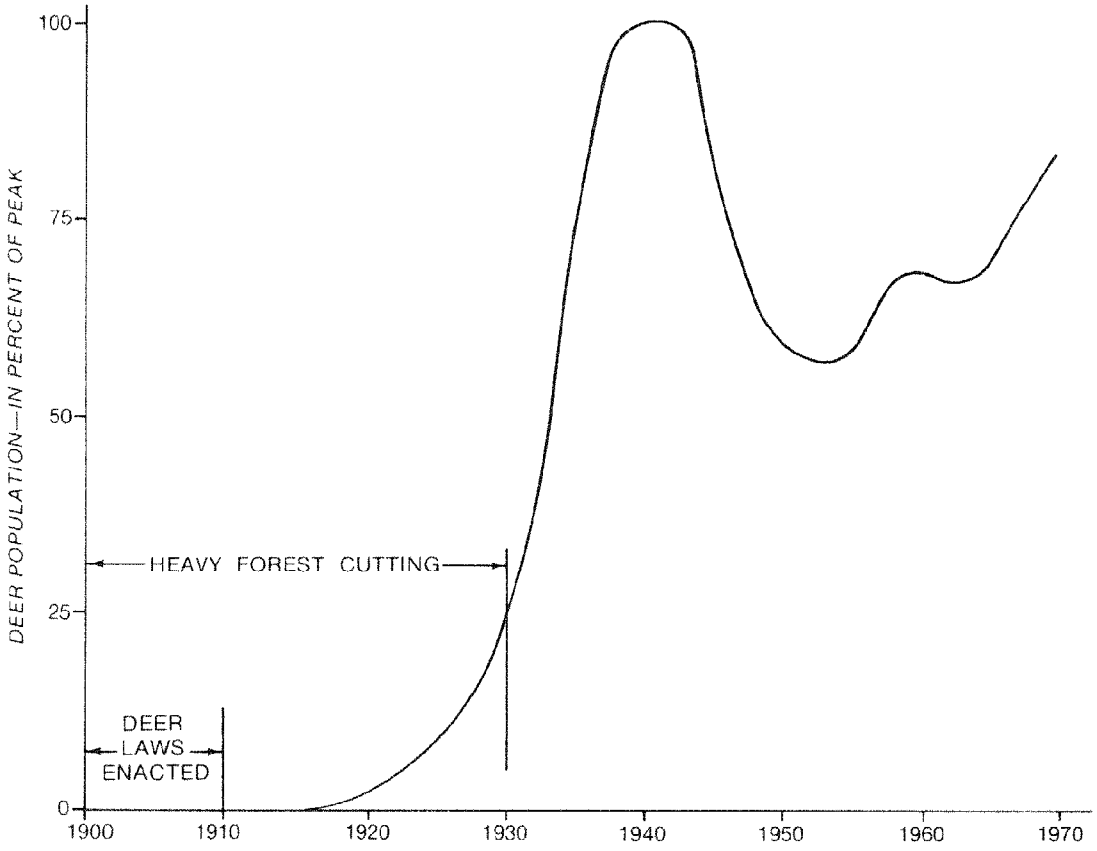
At about the same time that laws protecting deer were being enacted, extensive timber harvesting was providing increasing amounts of browse for the deer to feed upon. With predators eliminated, palatable browse accumulating in recently clearcut areas, and complete protection of does from hunting, the deer population was definitely on its way to an irruption.

As early as 1917, a few biologists began to warn that the deer population would soon be too large unless measures were taken to reduce further increases. The warnings were ignored. By 1922, deer were causing serious damage to agricultural crops and forest reproduction. In 1923, new laws permitted farmers to kill deer of either sex at any time of the year if they were damaging crops, and the state began providing free materials to farmers who wanted to fence their crop lands (*Leopold 1945, Winecoff 1930*).

Attempts to permit hunting of does began in 1923, but they were successfully boycotted or stopped by court injunctions obtained by sportsmen. Professional hunters were employed in 1927 in a futile attempt to reduce population levels in several critical regions. Fi-

Because of the changes in forest conditions, the deer population exploded. Now severe overbrowsing by deer hinders forest regeneration.

The deer populations in Pennsylvania from 1900 to 1970. Adapted from Leopold (1943), Bennett (1957), and records of Pennsylvania deer harvests.



nally, in 1928, the first statewide doe season was held.

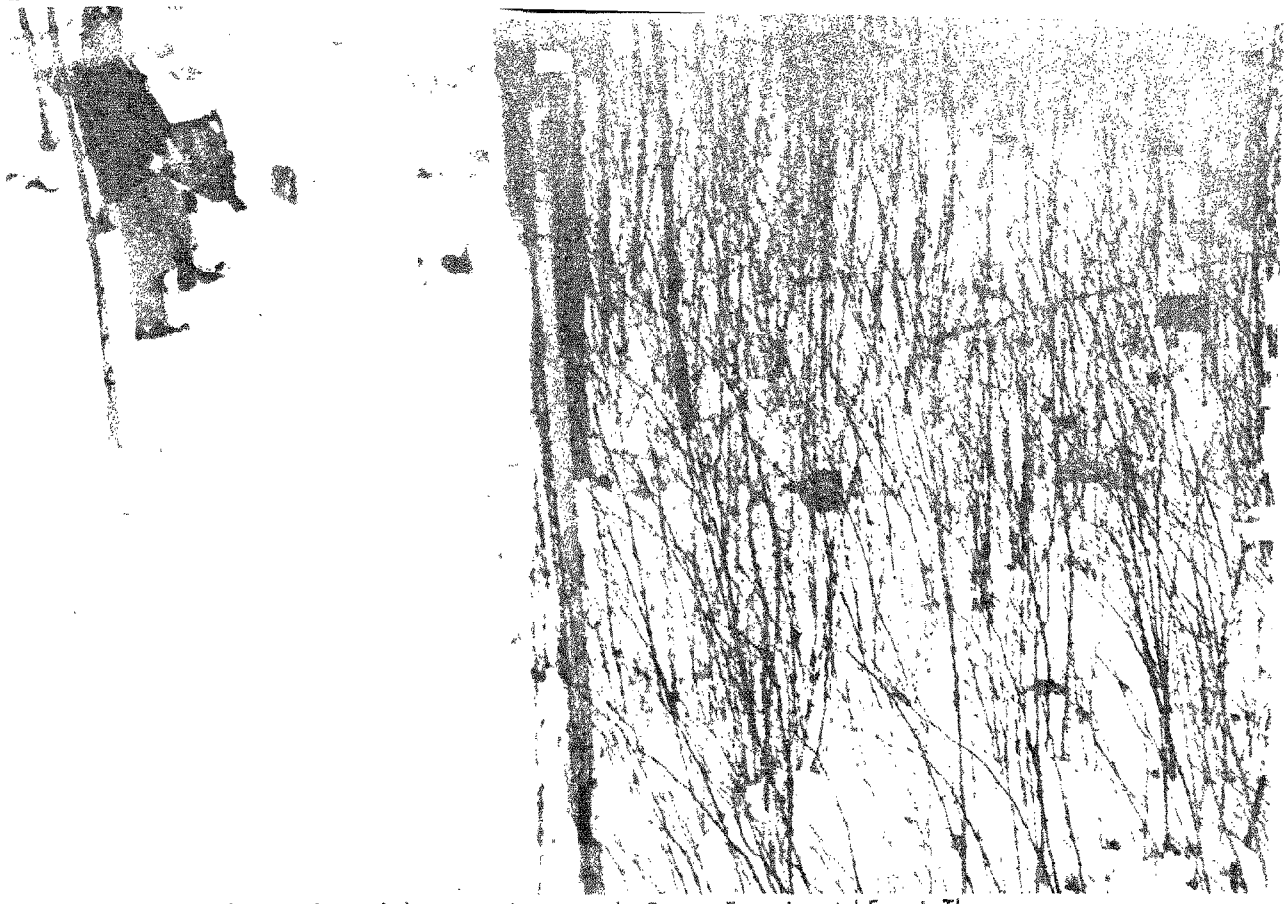
Large deer kills (as high as 186,575 in 1940) during the seasons of 1931, 1938, and 1940 checked the deer irruption and eventually brought the deer populations down from their peak levels, but not before severe overbrowsing had occurred. Vegetation less than 6 feet tall was completely eliminated in many areas, and available food supplies were badly depleted (*Leopold 1943*, *Winecoff 1930*).

Too Many Deer

During the 1930s, the last of the young second-growth forests were rapidly growing out of reach of the deer and into the small pole stage. Winter browse became extremely limited. Hunters began complaining about the small size of the deer and their thin unattractive antlers. Fishermen were shocked at finding hundreds of decaying deer carcasses along trout streams in the spring. During the winter of 1935-36, an estimated 40,000 deer died of starvation (*McCain 1941*).

Winter conditions were especially harsh due to the lack of protective cover resulting from the widespread clearcutting (*Maynard et al. 1935*). Occasional doe seasons and continued winter mortality eventually brought the herd down to half of its peak level.

During the peak years, local populations as dense as one deer on 5 to 6 acres were believed to be common. On study plots established by the Pennsylvania Department of Forests and Waters, every woody plant less than 6 feet tall



An experimental deer exclosure on the Pocono Experimental Forest. The area left of the fence has been browsed bare. Inside the fence, to the right, an abundance of seedlings have got a start.

had been completely destroyed or hopelessly injured at these densities. Tree planting had to be suspended in many localities, and continued clearcutting under such conditions would almost certainly have resulted in the elimination of tree growth (*Frontz 1930*).

By the early 1950s, deer populations in the state leveled off, then began increasing again in the 1960s. In the heavily forested northern Allegheny Plateau, damage to tree reproduction continues, and small deer size persists.

Evidence of a continued overpopulation is found in deer-browse consumption data collected on northeastern national forests. Twig-browse utilization is 3 to 10 times greater on the Allegheny than on the six other eastern national forests, and twig production has been reduced 2 to 3 times by overutilization (*Stiteler and Shaw 1966*).

Thus deer were not a factor when the present forests were being formed. Deer populations in 1900 were less than one one-hundredth of those at present. By 1920, when most of the clearcutting of Allegheny Plateau forests was complete, deer populations were still about one-third the size of those at present.

Current Conditions

The second-growth forests that originated after the clearcuttings of 1890-1920 are now 50 to 80 years old. Trees in the older stands are large enough to be valuable for timber. Wood-using industries declined greatly on the Allegheny Plateau after the original forest had been cleared, but began to increase again 10 to 15 years ago. As Allegheny hardwood forests reach maturity, they are again being harvested.

But things are much different this time.

Much of our forest land is now under some

One of the most valuable species on the Allegheny Plateau is black cherry. The man shown by this fine specimen is the late Ashbel F. Hough, who spent most of his career as a research forester studying the ecology and silviculture of black cherry and other Allegheny hardwoods.

sort of sustained-yield management. We have insured this by setting large acreages aside in our national and state forests, where cutting is carefully regulated and integrated with all of the other important uses.

Sustained yield is no less assured on the land owned by the wood-using industries, for their forests are their source of raw materials; and these lands too are managed under sound forestry principles to provide continuing supplies of timber for the owner's mills. So timber cutting will never return to the "cut-and-get-out" type of operation that saw the entire region cut over within a 30- to 40-year period.

Still Problems

Nevertheless, there are still some problems associated with the current cuttings. Considerable difficulty is being encountered in obtaining prompt regeneration after the mature trees have been removed. Instead of vigorous new seedling regrowth, such as occurred after the 1890-1920 cuttings, the areas sometimes regenerate to only a few trees, often of undesirable species—or to ferns, grasses, goldenrod, and similar vegetation.

The difficulty may be attributed to several factors.

First, the second-growth stands of today often lack advance regeneration—the understory of seedlings that sometimes occurs beneath mature trees. Advance regeneration was more abundant under the original forests, a natural consequence of their overmature condition, and was probably stimulated by the partial cuttings during the period before 1890. But the second-growth stands of today have not had the benefit of widespread partial cutting, nor are they old enough for natural mortality to provide openings in the canopy to stimulate understory seedling growth.

A second reason for the current difficulty lies in the large deer population of today. Deer feed heavily on woody twigs—especially during winter when other food is scarce. They suppress and destroy advance regeneration as well as new seedlings that develop after cutting. Where deer populations are large, they can prevent successful seedling regeneration from developing.

Foresters are well aware of the current problems and have taken steps to limit cuttings to stands that have good chances for successful regeneration—those that have adequate advance regeneration. Much research is under way to find ways of increasing advance regeneration, of protecting seedlings from deer, and of establishing new stands through seeding or planting so that our Allegheny hardwood forests will continue to provide all of the many goods and services we have come to expect from them.

A second-growth stand of Allegheny hardwoods today. One problem in regenerating these stands is the lack of advance regeneration—the understory of seedlings that are needed to grow up to become the new forest.

The hemlock trees in this early stand have been cut and the canopy openings thus created have permitted development of a good understory of advance regeneration. When this stand was later clearcut, a valuable second-growth forest quickly developed on the site.

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