



APPENDIX B: TECHNICAL REPORT – HISTORIC CONTEXTS

*Lumber Heritage Region
Draft Historic Contexts*

Before Timber: 1737-1784

Thematic Statement: Before systematic exploitation of timber products in the Lumber Heritage Region began, early exploration and settlement by Euroamericans set the stage for the development of the lumbering industry. The period begins with the initial visits that led directly to treaties and land purchases that enabled settlement in the southern and eastern portions of the region. It ends with the Last Purchase of 1784, which set the stage for settlement and timber harvesting throughout the region as a whole.

Narrative: After initial exploration, some of the earliest documented visits by Euroamericans to the area encompassed by the Lumber Heritage Region were by Moravian missionaries who established missions along the West Branch of the Susquehanna in the 1740s and along the upper Allegheny in the 1760s, and by diplomats, such as Conrad Weiser in 1737, sent to treat with the Native Americans of the region by the Proprietary Government. Also present were fur traders, whose journeys and interactions with the Native Americans were sanctioned by the Iroquois Confederacy, who controlled the region at that time (Groenendaal and Jones, 1998). During the period of Iroquois hegemony, the region was occupied by displaced Native Americans from various tribes, including the Delaware, Shawnee, Nanticoke, and Conoy (Shreiner, 1984). Often in mixed settlements, these groups occupied the region with the consent of the Iroquois, who, with the exception of the Seneca on the upper Allegheny, did not themselves occupy it. Little is known concerning this period in the region's history; it is represented by archaeological sites that contain evidence of European contact in the form of trade goods and sparse accounts of explorers, travelers, and missionaries (Grumet, 1998).

The southern and eastern portions of the Lumber Heritage Region were officially made a part of Pennsylvania with the Native American land cessions of 1754 and 1768, conveying all or portions of what is now Centre, Blair, Clearfield, Cambria, Indiana, Clinton, and Lycoming Counties to the Proprietary Government of Pennsylvania. Actual settlement of the area was impeded by the French and Indian War (1754 - 1758) and Pontiac's Rebellion (1763), but by the mid-1760s the first permanent Euroamerican agriculturally-based settlements had been established on the southeastern fringes of the region. In 1764, Scots-Irish Presbyterians settled at what is now Potters Mills in Centre County and in 1768, Samuel Wallis settled at Montoursville in Lycoming County. Settlement at Lock Haven occurred in 1769 (Linn, 1883)

In the summer of 1775, Reverend Philip V. Fithian traveled up the West Branch of the Susquehanna River and Bald Eagle Creek from Sunbury to what is now Milesburg in Centre County to minister to the pioneer settlements along the way, and described the conditions he encountered. Between Sunbury and Great Island just below Lock Haven, the banks of the Susquehanna were occupied by dispersed agricultural settlements, which

are depicted as productive and prosperous. Domesticated animals included cattle, sheep, and horses and crops of oats, wheat, and rye were under cultivation. There were extensive cleared pastures, fields, and gardens, and the settlers joined together at various points along the route to hear Mr. Fithian preach. It is noteworthy that Mr. Fithian does not mention sawmills or grist mills, or any other industrial endeavors. It seems likely that the economy of these settlements remained largely subsistence farming at the time of his journey. That a few industrial operations had been established is evidenced by the construction of a grist mill at Antes Fort in 1772 and a sawmill at Williamsport in 1773 (Shreiner, 1984, Taber, 1972)

From Great Island, Mr. Fithian continued up Bald Eagle Creek, but between Great Island and Milesburg, encountered no settlements. At Milesburg, he describes the uncut forest of the region:

“In this neighborhood (if I may be allowed to call it so) is a large quantity of spruce pine; the bark is black and fine; it is a straight, tall tree; the leaves are thinner, longer, and of a deeper green than other pine. It makes an excellent ingredient in table beer” (quoted in Meginness, 1889:456).

Of the extent of settlement in the area at that time, he remarks, “Mr. Boggs tells me he knows of no families westward of these but one higher up the creek” (quoted in Meginness, 1889:456). Thus, on the eve of the American Revolution, most of the Lumber Heritage Region remained under Native American control and was void of Euroamerican settlement. Only along the lower reaches of the West Branch was settlement relatively common.

During the Revolution, the Iroquois and their allies and dependents sided with the British, and war parties of Shawnee, Delaware, and Iroquois frequently threatened frontier settlements in Pennsylvania. In response, General George Washington commissioned a series of forts at intervals along the West Branch valley. Little more than stockaded residences, these forts were to provide a place of refuge for settlers on the frontier in the event of Native American hostilities, as well as a line of communications to Fort Augusta, the more substantial military fort at Sunbury. In all, six forts, extending from Muncy in the east to Lock Haven in the west, were constructed along the West Branch (Shreiner, 1984).

Encouraged by the British, Native American raids of the frontier began. This culminated with the Great Runaway of 1778, when all settlements in the area encompassed by the Lumber Heritage Region were abandoned, and the settlers fled to Fort Augusta. All of the fortified settlements to the north and west of Sunbury were abandoned and many were burned. Some settlers attempted to return to their homesteads shortly thereafter, but additional raids resulted in a second “runaway” in 1779.

In the decade following the Revolution, the displaced settlers gradually returned to their lands along the West Branch, Penns Creek, and Bald Eagle Creek (Groenendaal and Jones, 1998). From this time on, agricultural settlement proceeded continuously into the

interior portions of the Lumber Heritage Region, and early industries, including lumbering and saw milling, soon began.

Contact Period Property Types

Although not strictly related to the lumbering industry, several contact period property types were included in the historic sites inventory due to their importance in the early history of the region. These included Native American archaeological sites that have produced European trade goods, as well as the locations of documented contact period Native American towns. Also included were the locations of the Revolutionary War frontier forts along the West Branch. The locations of several Moravian missions on the upper Allegheny are also known, and were included in the inventory.

*Lumber Heritage Region
Draft Historic Contexts*

Pioneers of Logging: 1784-1850

Thematic Statement: The Pioneer context includes the period of initial settlement and the early development of small-scale, family-based lumbering. The economic base was subsistence farming supplemented by sale of minor amounts of farm produce. Small, family-operated sawmills were established as an integral part of the farming economy. They operated seasonally and had low output. The lumber produced supplied local needs, but was also shipped down the rivers and streams to markets as lumber rafts. Timber, log, and spar rafting also developed as alternative strategies for the exploitation of the region's timber resources. The period ends as small-scale, family-based production was superseded by industrial logging and lumber manufacture.

The Last Purchase of 1784

At the close of the Revolutionary War, the acquisition of the remainder of what is now Pennsylvania was negotiated with the Iroquois in the Treaties of Ft. Stanwix (1784) and Ft. Harmar (1789)(Ross, n.d.). In Pennsylvania, the southern boundary of this acquisition, which was termed the Last Purchase, followed the Ohio River to what is now Pittsburgh, and then continued up the Allegheny River to the location of Kittanning. From that point, it continued over the eastern continental divide to the headwaters of the West Branch of the Susquehanna River and followed that watercourse east to its confluence with Pine Creek. From there, the boundary followed Pine Creek, the upper reaches of Lycoming Creek, Towanda Creek, and the North Branch of the Susquehanna River to the New York State line. The northern and western boundaries of the Last Purchase in Pennsylvania were its borders with New York and Ohio. To the west of the Allegheny River and Conewango Creek, the new territories had been previously set aside as Donation and Depreciation Lands in 1777, to compensate Revolutionary War veterans for their service during that war (Kline and Hoogenboon, 1980)). The vast area to the east of the Allegheny was termed "Waste Lands". Encompassing much of the area in the Lumber Heritage Region, this entire area was officially opened for sale and settlement with the establishment of the first state land office in 1784, but in actuality remained effectively closed. The Seneca still occupied the Allegheny River valley, not officially recognizing the Iroquois land cession, and were hostile to settlement by Euroamericans (Ross, n.d.). In addition, lands were initially offered for sale at prices that were not attractive to potential settlers, and there were few takers. To remedy this situation the Pennsylvania legislature passed the Land Sales Act of 1792, which drastically reduced the price of land to the east of the Allegheny from 53 cents an acre to 2 cents an acre. It also offered Donation and Depreciation Lands west of the Allegheny for sale at 6 cents an acre (Kline and Hoogenboon, 1980). In all, over 4,000,000 acres of land were placed on the market at drastically reduced prices (Groenendaal and Jones, 1998). The intent was to

encourage occupation and improvement of the land by bona fide settlers (i.e. frontier farmers) rather than acquisition by land speculators, and the legislation contained provisions intended to ensure that buyers would actually occupy the tracts they acquired. In reality, however, the drastically reduced prices stimulated a massive rush to acquire land by wealthy individuals and land companies that evaded the requirement of settlement through proxy purchasers and technicalities in the legislation (Kline and Hoogenboon, 1980).

At the radically reduced price, investors could acquire huge tracts, and between 1792 and 1794, 5000 warrants of 1000 acres each were sold (Ross, n.d.; Groenendaal and Jones, 1998). Key investors included the Holland Land Company, consisting of Dutch investors and their Pennsylvania-based contacts; William Bingham of Philadelphia, reputed to be one of the richest men in America; Judge James Wilson, also of Philadelphia; and Samuel Wallis, who speculated in lands that would later become Lycoming County. Other investors of note included George Mead, Aaron Levy, Robert Morris, the Pennsylvania Population Company, and the Ceres Company. Many initial investors overextended themselves financially and, unable to pay taxes and warrant fees on their newly acquired lands, sold to other speculators or defaulted with their lands reverting to state and county land offices. This served to further consolidate holdings into larger tracts. As a result, vast amounts of land, especially in the rugged parts of the Lumber Heritage Region, then named "Waste Lands", were locked up in huge holdings of a relatively few investors, or reverted to the counties and remained on the unseated lands lists for decades (Groenendaal and Jones 1998; Ross, n.d.).

By the time the Seneca officially relinquished their claims to lands in northwestern Pennsylvania in 1795 (Ross, n.d.), settlement in the Lumber Heritage Region was discouraged by the consequences of land speculation. Due to repeated sales and resales, the claims of squatters, and conflicting land surveys, title to much of the available land was obscure. In addition, the Ohio Valley was opened to settlement in 1795 and provided relatively level and fertile land at reasonable prices with unambiguous ownership. In conjunction with the remote and rugged terrain of northcentral and northwestern Pennsylvania, these factors led settlers at the turn of the eighteenth century to bypass the area for more attractive opportunities to the west (Ross, n.d.; Groenendaal and Jones, 1998).

The speculative frenzy engendered by the Land Sales Act of 1792 had more lasting consequences as well. With unclear title and little interest on the part of settlers, many of the huge tracts consolidated by the speculators remained intact until the mid-nineteenth century, and still existed when industrial logging of the region began. Extensive, unsubdivided tracts of undeveloped forest land facilitated acquisition by lumber barons, contributing to the process by which the entire region was eventually clear cut and its virgin forests lost. With the onset of conservation and forest regrowth in the twentieth century, the same large land holdings facilitated the transfer of lands to the Pennsylvania and federal governments in the creation of the extensive public lands of the region (Ross, n.d.; Groenendaal and Jones, 1998).

Early Sawmills

The distribution of the earliest sawmills in the Lumber Heritage Region reflects the process of pioneer settlement and initial establishment of lumbering as a fledgling industry. The earliest mills were erected shortly before, and just after, the Revolutionary War. These mills were in the region of earliest settlement, along the West Branch of the Susquehanna River between Lock Haven and Muncy. One of the first sawmills was reportedly built in Williamsport in 1773 (Taber, 1972). Presumably, this mill was abandoned during the Revolution, but may have been rebuilt by the returning settlers. Other early mills were built in this portion of the Lumber Heritage Region in the mid to late 1790s, including mills on tributaries to the West Branch, such as Mosquito Creek, Lycoming Creek, Pine Creek, and Bottle Run (Groenendaal and Jones, 1998).

Another notable early mill was on Cornplanter's lands on the upper Allegheny. A Seneca chief, Cornplanter remained in the area after the 1784 land cessions and the subsequent relinquishment by the Seneca of their land claims in 1795. In the early 1790s, he settled with his followers on several tracts totaling approximately 1500 acres north of where Warren is now located (Schenck, 1887). With aid provided by Philadelphia-area Quakers, he built a sawmill just to the north of the New York State line in 1795, and made the first recorded sale of lumber in the Lumber Heritage Region (Groenendaal and Jones 1998; Ross, n.d.).

Perhaps the first Euroamerican lumberman to operate outside the lower West Branch drainage was Joseph Barnett, who traveled from what is now Lycoming County to the Redbank drainage to find a suitable site for a sawmill. In 1794, he located at the mouth of Mill Creek on Sandy Lick Creek and, with the aid of Senecas from Cornplanters settlement, began to construct a mill. In 1797, he rafted sawed lumber down Redbank Creek and the Allegheny River to sell in Pittsburgh (Scott, 1888).

The lumber industry also developed at a relatively early date along the Tioga and Cowanesque Rivers in what is now Tioga County. Since most of the North Branch valley was acquired by Pennsylvania during the earlier land cessions, settlement and lumbering activities along its length began relatively early. Focusing on white pine timber, small-scale and family-run sawmills succeeded in stripping this resource from areas accessible to streams. By the 1830's they had peaked, and by 1850 the entire upper North Branch drainage area experienced an economic slump as the lumber industry went into a precipitous decline (Taber, 1972). These forces were felt as far upstream as the Cowanesque and Tioga valleys, where sawmills were built as early as 1800 (Groenendaal and Jones, 1998).

With the turn of the eighteenth century, lumbering operations began to penetrate into other portions of the Lumber Heritage Region. An early focus of this activity was the Brokenstraw Creek drainage on the upper Allegheny. Here, early mills were built on Brokenstraw Creek at Garland and Spring Creek in 1800 and 1802, respectively, and in Freehold Township along Little Brokenstraw Creek in 1815 (Schenck, 1887). In 1801, the first lumber rafts transported the output of the Garland mill to Pittsburgh. Soon after, mills lined both banks of the Brokenstraw and Conewango Creeks, and rafts of both lumber and timber descended the Allegheny to

Pittsburgh on the seasonal floods (Ross, n.d.). Mills were also built along the upper reaches of the Allegheny proper during the early penetration of the region, including one in Mead Township, Warren County (1806); one in Burtville, Potter County (1815); and one in Liberty Township, McKean County (1815) (Schenck, 1887; Leeson, 1890). Other areas where early mills were built included the upper Sinnemahoning drainage, with mills at the mouth of North Fork and at Emporium in Cameron County (1811 and 1814, respectively) (Leeson, 1890), and along the Bald Eagle Creek at Beech Creek in 1818 (Linn, 1883; Groenendaal and Jones, 1998).

The distribution of early mills in the Lumber Heritage Region indicates that contrary to expectation, the harvesting of timber apparently did not proceed up major rivers and streams in a linear fashion, gradually penetrating further and further into the interior of the region. Instead, many of the early mills were located in remote, interior areas, far from major streams and confluences. Examples include Barnetts mill in the upper Redbank drainage, early lumbering in the Brokenstraw drainage, and the early mills in the upper Sinnemahoning drainage. Presumably, early lumbermen sought out prime tracts of timber well-situated for harvesting, secured title to the land, and located their mills accordingly.

It is also notable that the number of reported mills dating to the period before 1820 is small (although it should be mentioned that secondary sources vary widely in their coverage of the lumbering industry). Presumably, this reflects the slow pace of overall settlement in the region, a consequence, in part, of early land speculation. After 1820, and continuing through the 1830s, the industry gradually expanded throughout the region with the establishment of more sawmills and associated small settlements. Nevertheless, the process was slow. For example, the first mill in Ridgway, Elk County, was not established until 1827. Schenck reports that, in 1825 in Columbus Township, Warren County, the lumber trade had not yet become very prominent, although "...it was in full tide further down river." (Schenck 1887:485) In still more remote portions of Warren County, the first sawmills were not established in Farmington and Elk Townships until the 1830s (Schenck, 1887). In McKean County the first mills were not built until as late as 1838 on Portage Creek in Liberty Township, and the second mill along the same stream was not constructed until 1848 (Leeson, 1890). Reported dates of first mills suggest, however, that by 1850 the process of initial settlement and mill construction within the Lumber Heritage Region was essentially complete.

Pioneer Lumbering Operations

All of the sawmills established in the Lumber Heritage Region during the period between the mid-1790s and 1830 were small, family-sized operations; and most, if not all, were integral components of functioning farms. In addition to the mill owner and his sons, the labor force was limited to one or two additional hands (Groenendaal and Jones, 1998). Logging and saw milling during this period were seasonal; trees were felled and logs skidded to the mills during the winter when frozen ground and snow cover facilitated skidding. Lumber rafts were built and floated downstream to markets on spring floods. During the summer, mills were often idle due to low water levels in streams, and the lumbermen of the era turned their efforts to farming (Ross, n.d.).

The early mills were all water-powered and contained a single reciprocating sash saw. Most are described as powered by undershot flutter wheels, but some, especially those sharing power with an associated grist mill, used overshot wheels (Groenendaal and Jones, 1992; Beebe, 1934).

McKnight (1905) describes the mills of the pioneer period:

“The early up-and-down saw mills were built of frame timbers mortised and tenoned and pinned together with oak pins. In size these mills were from twenty to thirty feet wide and from fifty to sixty in length, and were roofed with clapboards, slabs, or boards. The running gear was an undershot flutter-wheel, a gig-wheel to run the log-carriage back, and a bullwheel with a rope or chain attached to haul the logs into the mill on and over the slide. The total cost of one of these up-and-down mills when completed was about three hundred dollars, one hundred dollars for iron used and two hundred for the work and material.” (Quoted in Groenendaal and Jones, 1998:np)

The output of these single saw, seasonal mills was low, variously described as less than 100,000 board feet per year (Ross, n.d.), or less than 1000 board feet per day (Groenendaal and Jones, 1998).

Although the lumber sawed by pioneer era mills supplied local needs for building materials as settlement of the region continued, a substantial portion of the output was conveyed to downstream markets as lumber (or board) rafts (Scott, 1888). Tonkin (1958) describes the type of lumber raft employed in the West Branch drainage:

“It took the form of a raft made up of 1 or 2 inch lumber usually 16 feet square with courses of lumber to make a depth of 18 to 20 inches. These were coupled together by an ingenious method to make a desired length of raft. Control was with sweeps or oars on the same principle as timber rafts.”

As indicated above, lumber was rafted down Redbank Creek and the Allegheny River as early as 1797 by Joseph Barnett, and out of Brokenstraw Creek as early as 1801. Clearly, as soon as the first sawmills were established, lumber rafts began traveling downstream to markets. Often, raftsmen walked back to their homes after arriving at their destinations. Alternately, some carried canoes on their rafts, and returned with canoe loads of goods and provisions.

Not all the streams of the region were suitable for raft navigation initially, being shallow and choked with obstacles. In these situations, pioneer era raftsmen cooperated in improving streams and rivers to accommodate the traffic. Encountering such a situation, lumbermen working in the Toby Creek drainage, now the Clarion River, in Jefferson County in 1828 cooperated to clear the stream, allowing the first lumber rafts to descend the stream and ultimately reach Pittsburgh. Interestingly, these first rafts are described as crudely built and of questionable durability, and the raftsmen as inexperienced, making this first run adventuresome (Scott, 1888). Lumber rafts were run down the Sinnemahoning in fleets of “pieces” or half-rafts due to the crooked and narrow stream, and then assembled on the West Branch before continuing to Marietta (Beebe, 1934).

Board rafts were run only as far as Marietta on the Susquehanna River due to unsuitable water conditions below that point (Beebe, 1934; Tonkin, 1958), but on the Allegheny they were run beyond Pittsburgh to Cincinnati, Louisville, and even as far as New Orleans. Some raftsmen returned from the latter destination by taking a ship to Baltimore and walking back from there.

It should be emphasized that the production and rafting of dimension lumber¹ by pioneer lumbermen was only one component of the lumber industry of the time. Other important industry included harvesting the best pines for spar timber and floating these downstream as spar timber rafts. The key features of this industry are described more fully below. It may have begun in the Lumber Heritage Region as early as the 1790s, with spar lumbermen being among the first to penetrate the interior parts of the region in search of prime pine timber (Groenendaal and Jones, 1992). From the beginning, spar timber lumbermen were specialists engaging in a highly skilled craft; they were viewed as the elite of the lumbering industry (Tonkin, 1958). Within the Lumber Heritage Region, spars were rafted only from the West Branch drainage, and from there down the main stem of the Susquehanna and the Chesapeake Bay to shipbuilding centers at Baltimore and on the Atlantic coast (Tonkin, 1958). Spar timber harvesting on the Allegheny is less well documented, but probably began during pioneer times to supply markets in New Orleans.

Also initiated along with the first sawmills and farms was the rafting of square timber. Again, this industry is described in more detail below. In contrast with the spar timber industry, construction and navigation of a square timber raft was within the capability of virtually every able-bodied pioneer, and was an ubiquitous part of pioneer life within the Lumber Heritage Region. Timber was cut and hewn during the winter months when there was little farm work to do and the rafts were constructed in the early spring to be ready for the spring flood. "Each settler would get out a raft in the winter season and in the spring run it to Big Island...and trade it for provisions." (Leeson, 1890:869). As with other rafts, timber rafts were run downstream to Pittsburgh and below on the Allegheny, and as far as the Chesapeake Bay on the Susquehanna. Although many farmers navigated the rafts they built, others preferred to hire expert pilots for this. For example, Smith Labree of Kinsua Township in Warren County "...acted as a pilot...and made many trips down the Allegheny River, once going as far as Natchez, Mississippi." (Schenck, 1887:477-478).

During the pioneer era, timber rafts, as well as similar rafts constructed of unhewn saw logs, were run downstream to sawmills at places such as Lock Haven, Williamsport, Marietta, and Pittsburgh for the production of dimension lumber. For example, Jesse Armstrong from whom Armstrong Bend in Jefferson County gets its name, is described as having built a raft of round logs and run it to Pittsburgh (Scott, 1888). Timber rafts also supplied markets for barn and house timbers, dock timbers, and the like.

Although production and rafting of dimension lumber, spar rafting, and timber rafting were the

¹ "softwood construction lumber from 2 inches up to, but not more than 5 inches thick, and 2 inches or more in width" (Sinclair, 1992: 388).

dominant components of the lumbering industry during pioneer times, there are occasional references to other lumbering endeavors. Schenck (1887), for example, describes the early lumbering industry in Deerfield Township, Warren County, as starting with the splitting of lath and floating bundles of it downstream to markets. Leeson (1890) indicates that both settlement and lumbering began late in Otto Township of McKean County with the establishment of a farm and the erection of a shingle mill in 1842. Although far less prevalent than sawmills, tanneries occasionally appear in early township tax rolls within the region, indicating that presumably small, family-run tanneries were established during the pioneer era (Leeson, 1890). Considering the dearth of such references in available sources, endeavors such as these must have been minor compared to the various rafting industries. Indeed, the early importance of rafting is reflected by state legislation, which made all the principal rafting streams of the Lumber Heritage Region public highways as early as 1798 (Beebe, 1934; Schenck 1887).

Lumbering and the Pioneer Era Economy

The lumbering industry played an important role in the initial settlement of the Lumber Heritage Region. As indicated above, spar timber lumbermen may have been among the first to explore the area thoroughly. More importantly, many of the earliest settlements were made by pioneers who sought new opportunities in the lumber business. Among these was Joseph Barnett, who came to the upper reaches of the Red Bank in 1797 to find good timber and a site for a sawmill (Scott, 1888). However, the next settlers were farmers and Barnett soon added a grist mill to his establishment to process their grain, as well as that of the local Native Americans. His residence also became the first tavern in Jefferson County (Scott, 1888).

Whether initial settlement of an area was for the purposes of building a sawmill or establishing a farm, saw milling was a prominent pioneer industry in the Lumber Heritage Region from the start. Early tax rolls for McKean, Elk, and Potter Counties suggest that, in general, one out of every 20 taxable inhabitants owned a sawmill in the decade following initial settlement (Leeson, 1890). As indicated above, the output of these mills was rafted on an annual basis to downstream markets, providing access to needed commodities and the means to purchase them. Timber rafting played a similar role in the pioneer economy, but was even more pervasive, since the skills and equipment to produce timber rafts were possessed by the general farming population of the time. Thus, nearly every farmer engaged in lumbering to some extent, either through timber rafting, saw milling, or working as a laborer at a nearby sawmill (Schenck, 1887).

Along with agricultural surpluses, timber products were an important supplement to the basic farming economy of the regions' pioneers.

Although less prevalent than sawmills, grist mills were also important in the pioneer economy of the region. Interestingly, references to grist mills indicate that they were usually built as parts of joint saw and grist mill complexes, presumably to take maximum economic advantage of a single power-generating complex that consisted of capital intensive dams, wheels, and raceways. Early joint saw/grist milling complexes are described, for example, at Centre Furnace in Center County in 1794 (CCH 1996), at Burtville in Potter County in 1815 (Beebe, 1934), in Sugar Grove Township in Warren County prior to 1830 (Schenck, 1887), and in Brokenstraw Township

between Warren County in 1825 and 1830 (Schenck, 1887).

Early pioneer mills also played an important role in the economic history of the Lumber Heritage Region. Late nineteenth century historians commonly describe the locations of these early mills as having been “where _____ mill now stands”, indicating that mill locations tended to remain stable over time, with the early pioneer mills being replaced at the same locations by larger industrial mills as the lumbering economy of the region developed. The mills thus played a role as economic central places. As the mills grew, so did their work forces, and the settlements associated with them grew into the towns and cities of the Lumber Heritage Region.

Pioneer Lumber Industry Property Types

Property types of the pioneer lumbering industry include family sawmills with mill dams, raceways, skid roads, residences, and outbuildings. Occasionally, a grist mill was also a part of this industrial complex. A second pioneer era property type is the family tannery, with the tannery outbuilding, residence, and outdoor tanning vats. Substantial numbers of pioneer sawmill complexes were identified from selected early historic maps, and are included in the inventory. One of these contains a grist mill as a part of the complex. None of these pioneer sawmills are known to be extant, but archaeological remains likely exist at some of them. No family tanneries of the pioneer era were located.

*Lumber Heritage Region
Draft Historic Contexts*

Spars and Sticks: Timber Rafting and Log Booms: 1830-1921

Thematic Statement: With the depletion of the white pine forests of Maine and New England in the 1830s, the focus of lumbering turned to New York and Pennsylvania. To supply ever growing National markets for lumber, square timber, and spars, lumbermen from Maine and Canada brought the technology of industrial lumbering to the region, where prime stands of white pine remained to be cut. These men began to invest in timber lands, and established the beginning of the industrial lumbering operations.

Within the West Branch watershed, the core industrial lumbering complex of the time consisted of sawmills that were supplied by a water-based system for transporting logs. The key components of this complex were logging camps, log slides, splash dams, log drives, and log booms. Dimension lumber produced by these mills was shipped to markets principally by canal. Timber rafting, however, continued as an alternative, non-industrialized, competing system of timber resource exploitation, and became a professionalized and specialized endeavor. Unable to compete with log drives in supplying the mills, rafting came to focus on specialty products, especially square timber and spars.

Similar changes occurred within the Allegheny watershed, but here, the log drives and log booms were not used. Instead, logs were hauled overland, splashed down streams, and rafted as logs or timbers to mills. Mill output was then primarily rafted to markets in enormous lumber rafts.²

Industrial lumbering based on water transport continued within both watersheds until timber resources accessible to watercourses were exhausted. At about this time railroad logging also developed. Between 1885 and the demise of water transport systems in the early twentieth century, rafting and log drives competed with common carrier and logging railroads as systems for timber resource transport. The water transportation context ends with the last commercially-run rafts on the Clarion River in 1921.

Early Industrial Lumbering

Before 1830, Maine was the center of the lumbering industry in the eastern United States. However, with the depletion of the Maine forests, professional lumbermen turned to New York in the 1830s, and shortly thereafter, to northcentral and northwestern Pennsylvania (Taber, 1995; Ross n.d.). These men supplied a growing market for wood products, as East Coast cities and towns continued to grow and prosper in post-Revolutionary War times, and as the new Nation expanded westward. They brought to Pennsylvania the core technology of professional lumbering as it had been

² The water transport era of lumbering on the Allegheny is less well-documented in secondary sources than on the West Branch. This narrative reflects this.

developed in the forests of Maine: “chip-chopping” to fell trees, skidding logs to streams, splash dams and log drives to move logs to mills, and log booms to capture and store logs where the mills were located (Tonkin, 1958; Ross, n.d.).

In northcentral and northwestern Pennsylvania, these lumbermen found some of the finest stands of white pine in the United States. In these regions, the pine belt stretched from Susquehanna County across Bradford, Tioga, and Potter Counties, and then to the southwest over Cameron, Elk, and Clearfield Counties. By the 1830s, the lumber industry was well established in Susquehanna and Bradford Counties, leaving the West Branch and Allegheny drainages with the largest expanse of uncut white pine timber in the state (Taber, 1972b).

Certain areas in particular were famous for the quality of their pine timber. Among these were the Pine Creek drainage in Tioga County (Taber, 1972b), the Oswayo Creek drainage in Potter County (Beebe, 1934), and the Bennett Branch drainage in Clearfield and Elk Counties (Huntley, 1936).

As the quality of the region’s pine forests became better known, lumbermen started buying timber tracts, many of which were still available at state and county land sales offices or in large land holdings of individuals and land companies (Taber, 1995; Ross n.d.). Among the notable speculators of the time was William Dodge of the New York firm of Phelps, Dodge and Company, which began purchasing timber lands in Tioga County in the 1830s. Later, William Dodge would build and operate the largest sawmill in Williamsport. Other speculators from New England and New York bought large tracts at the headwaters of Redbank Creek and the Clarion River from the Holland Land Company at about the same time (Scott, 1888; Groenendaal and Jones, 1998). Somewhat later, another famous lumberman from New York, John DuBois, started consolidating timber lands in Clearfield County (Kline, 1975). DuBois also built one of Williamsport’s premier mills and became a key figure in the construction and operation of the Susquehanna Boom at Williamsport. Later, he established the lumber industry at Dubois, which is named after him.

The migration of professional lumberman from New England and New York marked the transition from small, family sawmills to industrial lumbering in Pennsylvania. These men imported the technology of log drives and log booms, established larger operations, and radically increased the scale of production of dimension lumber. However, the transition to industrial lumbering occurred at varying times in different portions of the Lumber Heritage Region. In Warren County, for example, lumbering became big business at a relatively early date, and is described as at its height as early as 1836-1840, when “In the spring time the principal streams of the county would be almost covered with rafts of manufactured lumber...” (Schenck, 1887:150). By 1837, there were approximately 100 sawmills in Warren County, with an annual output of 45,000,000 board feet (Marquis, 1975). In marked contrast, large scale lumbering on the upper reaches of the West Branch began as late as the 1870s. In Indiana County on Cush Cushion Creek, for instance, there were only small water-powered mills producing for local markets until 1872 (Tonkin, 1958).

At the headwaters of Redbank Creek and the Clarion River in Jefferson County, new operators began industrial logging between 1830 and 1837 (Scott, 1888). Also in Jefferson County, a mill built in Pine Creek Township was sold to "...Alpheus Shaw, who in turn sold to Amos Austin and Josiah Rogers, two restless, Yankee lumbermen from New England, who (were) on the lookout for a more productive lumber country" (Scott, 1888: 491). Otto Township in McKean County was still essentially a wilderness as late as 1842 when the first settlers there built a shingle mill and later a sawmill in 1849. In 1851, the timber lands and the mill were sold to new owners from New York, who "...cleared the streams, built splash dams, and drove the logs to Olean 'Yankee Fashion', where they built mills and manufactured for the eastern market" (Leeson, 1890:302).

Also around ca. 1830, Hezekiah Stowell came to Tioga County from New England and bought 10,000 acres of timber lands from which he started the first industrial scale lumbering operation in the county. The output of his three large mills near Ansonia was rafted down Pine Creek and the Susquehanna River to eastern markets (Beebe, 1934). Another Pine Creek operation, Phelps Mills in Clinton County, was started by Anson G. Phelps of New York, who purchased a grist mill there in 1847, then erected a large sawmill. In 1856, he built an additional large steam-powered mill and, between the two mills, had 64 gang and English saws and eight circular saws with a total annual capacity of 8,000,000 board feet (Linn, 1883).

Native Pennsylvania speculators and lumbermen also played a role in the transition to industrial lumbering. In 1828, John Cook came to region from eastern Pennsylvania and bought timber lands in northern Jefferson County. Initially, he built and ran timber rafts, and then built a sawmill to manufacture square timber and dimension lumber. He founded the lumber empire of the Cook family, from whom Cooksburg and Cook Forest State Park originated (Kline, 1975).

In Potter County, industrial lumbering began in 1837 with the founding of the Oswayo Lumber Company, which subsequently built three large sawmills at Millport (Beebe, 1934). In Shippen Township in Cameron County, large scale lumbering began in 1847- 48 with construction of the first large sawmill. The "...business of floating logs..." began in 1849, by which time there were extensive sawmills at Sinnemahoning, Sterling, Cameron, and near Emporium (Leeson, 1890). In the vicinity of Beech Creek in Clinton County, industrial lumbering developed between 1842 and 1850 with the establishment several large water-powered sawmills (Linn, 1883; Groenendaal and Jones, 1998).

Industrial lumbering in Williamsport began with the construction in 1840- 41 of what was called the Big Water Mill. Because there was little drop in the river at Williamsport, the only feasible way to power a mill using water was by damming the West Branch; this was accomplished by constructing a two-foot high dam across the river at the upstream end of Hepburn Island. The Big Water Mill was built on the breast of the dam, straddling the river between Hepburn Island and its north bank. It is reported to have originally contained two waterwheels and two sets of saws, and in the 1850s it was expanded to contain four wheels and four sets of saws. Never profitable, the Big Water Mill burned in 1862 and was not rebuilt (Taber, 1995).

In addition to the forests themselves, an important factor facilitating the transition to industrial lumbering in the West Branch drainage was the construction of the region's canal system. Between 1830 and 1842, the Western Division of the Pennsylvania Canal was completed to Williamsport and Lock Haven, and the Bald Eagle Extension continued up the Bald Eagle Creek as far as Milesburg. The canal helped stimulate the interest of speculators since it opened the huge Philadelphia market to the timber products of the West Branch (Ross, n.d.; Groenendaal and Jones, 1998). Due in large part to the canal, Williamsport and Lock Haven would be selected as locations for log booms, and would develop thriving lumber industries based on water transport of forest resources. Lacking a canal along its length, the Allegheny River itself became a primary transportation facility for timber resources, and was made navigable for its entire length for the passage of rafts, arks, barges, and boats (Groenendaal and Jones, 1998).

With the increase in the scale of operations came the professionalization of the lumber industry. As early as the 1830s, specialized woodcutters began to operate out of lumber camps located near the tracts being cut. These operations were normally run by timber cutting contractors, known as jobbers. Jobbers were retained by sawmill and timber tract owners to cut and transport logs to the mills. With relatively sparse populations of early settlers, the counties of the Lumber Heritage Region had insufficient manpower to meet the needs of the growing industry, and many workers, known locally as "woodhicks", moved to the area from the eastern Canadian provinces, New England, and especially Maine. Huntley (1936), for example, indicates that during the rafting/log drive era on the Sinnemahoning, many of the woodhicks were from Ontario, Quebec, and New Brunswick. Similarly, Tonkin (1958) describes Cush Cushion Creek loggers as primarily from Canada and Maine. The jobbers were frequently immigrants from these regions as well, since they were the ones with the specialized skills needed to organize and supervise logging operations. Beebe (1934:172) describes a Kettle Creek jobber from Maine who left for California, "...taking many of the Downeasters who had come to Kettle Creek with him from the state of Maine." The influx of loggers and sawmill workers from Canada and New England, and later from Europe as well, would continue until the decline of the lumber industry in the early twentieth century. The ethnic composition of the region was significantly affected by the influx of men working in the lumbering industry.

Although there were exceptions such as the Cush Cushion Creek watershed, industrial lumbering had penetrated most of the region by 1850. By 1849, McKean County mills produced 14,500,000 board feet of pine lumber and 5,000,000 board feet of cherry (Leeson, 1890), and 1851, 83 sawmills in Potter County had an annual output of 20,750,000 board feet. Evidencing the growing importance of the industry as well as its political influence, in 1871 the Pennsylvania legislature passed the "Act to Allow Improvements to Creeks and Rivulets," which in essence gave lumber companies the right to erect splash dams, clear streams, and make other improvements along watercourses to move logs, whether or not the stream had been declared a public highway, and whether or not they owned the land on which the improvements were to be made (Tonkin, 1958).

Timber Rafting

As industrial logging and lumber production developed, rafting of timber products also increased in scale in response to the growing National market for timber products. On both the Allegheny and the West Branch, square timber and spar timber rafts supplied the shipbuilding industry with framing material, masts, booms, and bowsprits, and the building and dock construction industries with square timber for framing. On the Allegheny, huge rafts constructed of dimension lumber transported the output of the big mills to downstream markets, and log rafts continued to supply the mills with saw logs. Collectively, the board foot output of rafting rivaled that of the big industrial saw mills. However, individual rafting operations remained small, non-industrialized, and often family level endeavors.

The four principal types of rafts run on the rivers and streams of the Lumber Heritage Region - timber rafts, log rafts, lumber rafts, and spar rafts - were built differently, and were destined to different downstream markets. Boats were also used to transport lumber products to markets, and were themselves one of the products on the lumbering industry of the Allegheny watershed. The boats used were variously referred to as arks, barges, and flatboats.

Timber Rafts: Timber rafts were among the first modes of transport in the region, dating back to the early years of the pioneer lumbering era. Their construction began in the forests with the felling of suitable trees, usually white pine or white oak large enough to produce long, straight "sticks" of squared timber. The technique of raft construction has been described in detail elsewhere (e.g. Tonkin, 1958; Huntley, 1936; Frank, n.d.), but to summarize, square timbers were hewn during the winter months then skidded using horse traction to a nearby rafting-in ground on the banks of a rafting stream or river. In late winter and early spring, rafts were assembled at these locations in anticipation of the spring flood. Timber rafts were composed of three platforms, each built separately then cobbled together. A platform consisted of timbers fastened side by side by lash poles attached with bows and pins. Three platforms were attached end to end to form a "half raft" that was approximately 120' long. Selected timbers extended between adjacent platforms called stiffeners. These provided structural integrity to the assembled raft, while allowing it flex sufficiently to pass over dams and rapids.

To each end of the raft, large oars were attached. These were used to move the raft from one side of the river to the other, as needed to avoid obstacles, guide the raft through the chutes of dams, and bring it along the bank to tie up. A shelter for cooking and sleeping was erected on the assembled raft. On the upper reaches of streams where the channel was narrow and the bends frequently sharp, half rafts were rafted separately, each with its own crew. On the lower reaches, two half rafts were joined to form a full raft, which was nearly 300' long and contained 84,000 board feet of square timber (Frank, n.d.; 1978).

Timber rafts of pine and oak were common. Rafted pine timbers supplied downstream saw mills, and were also used as major structural supports in house, barn, and bridge construction. Oak timbers were principally sold to the ship building industry for use as keel timbers and ship framing. Lacking buoyancy, oak rafts had to be comprised of at least ten percent pine timbers, but were nevertheless very wet to run (Frank, 1972).

Log Rafts: The most prosaic of all the common raft types, construction of log rafts is not well documented. Especially in the period before the construction of log booms, log rafts were a principal way to supply downstream sawmills with logs, and the early mills at Williamsport were built to receive logs in this way (Taber, 1995). Even after the construction of the booms, mills further downstream than those in the boom towns needed logs, and log rafts continued to supply them, albeit in far fewer numbers. This is evidenced by photographs of log rafts in Huntley (1936), Tonkin (1958), and Frank (1978) and by an account of a rafting accident in 1878 involving a “round timber” raft and a “square timber” raft at Wood Rock, a well-known rafting point on the West Branch (Frank, 1972). Leeson (1890) reports that “...construction of log rafts is now [in 1890] a thing of the past. Occasional lumber rafts are sent down, but in the old days log rafts were sent to Pittsburgh and below, and as far as the Chesapeake via Pine Creek and the Sinnemahoning” (Leeson, 1890:984).

Lumber Rafts: Constructed of dimension lumber produced at upstream mills, lumber rafts were the principal means of delivering boards to market on the Allegheny River and its tributaries, and on the West Branch prior to the completion of the canal. M. J. Colcord, as quoted in Beebe (1934) describes a typical West Branch lumber raft of this early period:

Three narrow plank runners ... were laid for the bottom of each platform. A layer of boards across these was followed by another lengthwise, and so on till the platform was of the proper thickness. Three hinge boards extended half their length to the next platform ... and thus the long string of platforms made up the raft, flexible but strong. ... At each end, a head-block supported a huge oar, with a tapering stem ... into which a sawn oar blade was mortised... These rafts were generally run to Marietta or Havre de Grace in fleets of four such ‘pieces’ or half rafts, such as could be run out of the crooked and narrow Sinnemahoning (Beebe, 1934:166-167).

Clearly, lumber rafts had much in common with timber rafts, both being constructed as platforms joined by stiffeners and guided by large oars mounted at each end. The fully developed lumber rafts of the Allegheny were enormous; increasing in size as the river became larger downstream. On headwater streams, platforms measuring 16 feet square and 18-25 inches thick were made, and four or five of these were joined together end to end to form an upriver lumber raft (termed a “piece”) that was 16 feet wide and 73 feet or 92 feet long. As the rafts proceeded downstream, the pieces were coupled together to form larger rafts (called “fleets”). At Larrabee or Millgrove, for example, four “pieces” were coupled to form a “Warren” fleet, which measured 32 feet by 149 feet or 187 feet. Four Warren fleets were put together at Warren to form a Pittsburgh fleet, and at Pittsburgh, four or more Pittsburgh fleets were joined to make an Ohio River fleet. Ohio River lumber raft fleets were huge, covering up to two acres of water, and containing up to 1,500,000 board feet of dimension lumber. They had shelters for cooking and sleeping, and were run both night and day down the Ohio and Mississippi Rivers. In this way, the production of the Allegheny watershed sawmills was conveyed to markets as far away as New Orleans (French, 1995).

Spar Rafts: Within the West Branch watershed, prime stands of pine timber existed, and a market for spars was readily accessible at Baltimore. The majority of the spars from the region came from the highest quality stands of white pine timber, especially those of the Chest Creek, Clearfield Creek, Pine Creek, Sinnemahoning Creek, and the upper West Branch (Frank, 1972.). As timber was cut in these areas, the spar quality trees were removed first by “spar makers,” who were highly trained specialists and considered the aristocrats of the lumbering industry. A spar quality tree was carefully felled onto another previously felled tree to avoid snapping it. One method of accomplishing this was the triple cut, which involved felling the spar tree so that it leaned against another nearby tree, and then cutting the latter so that it fell against a third tree, which in turn felled, bringing all three trees to the earth. In this manner, the spar tree came down in stages and landed on top of two other trees, breaking its fall (Evanetski, n.d.) After felling, the spar tree was trimmed of branches and the bark peeled. The base of the spar was sized to the diameter of the tree at a distance of 12 feet from the butt, and a tenon (a projection on the end of a piece of wood shaped for insertion into a mortise to make a joint) was cut on both ends with a hole through each tenon. Spars had to have a minimum diameter at the small end of 18 inches, and were either 93 feet or 120 feet in length. After being made, they were hauled to rafting-in grounds by teams of up to 14 horses, the butt end of the spar being chained to a huge spar sled, and the small end dragging behind (Frank, 1972.). Alternately, teams of oxen might be used to haul spars, because they were less expensive to equip and maintain than horses (Huntley, 1936). On steep slopes, spars were slowed by snubbing with ropes and snubbing stumps, a dangerous procedure since snubbing ropes might break and allow the spar to run free to crush both team and teamster (Huntley, 1936; Tonkin, 1958). The largest spars were especially difficult and dangerous to move. Records indicate that the largest spars were 120 feet long and as much as 23 inches in diameter at the small end. They weighed as much as six tons (Frank, n.d.; Huntley, 1936; Tonkin, 1958).

At the rafting-in ground, spars were assembled into spar rafts. A spar half raft consisted of ten spars joined side by side with lash poles laid on the tenons on the ends of the spars and connected to the spars using hickory withes threaded through the holes in the tenons. Two half rafts joined together end to end comprised a full spar raft (Frank, 1972.), although sometimes especially long spar rafts consisting of three half rafts were made. These were very difficult to stop, since they frequently broke even the heaviest snubbing ropes (Huntley, 1936). Spars were rafted to Port Deposit, Maryland, where a full spar raft sold for \$3,000.00 to \$5,000.00. The spars went from there to shipbuilders in Baltimore, Philadelphia, and Boston (Frank, 1972.).

Although it has been stated that spar rafting within the Lumber Heritage Region was limited to the West Branch drainage (e.g., Taber 1972b), there is evidence that it was also practiced within the Allegheny watershed. Scott (1888), for example, indicates that of all the various timber products rafted out of Redbank Creek in 1866, there were \$300,000 worth of “...shingles, lath, boat gunwales, *spars*, etc.” (Scott, 1888:584, emphasis added). Evanetski (n.d.) explicitly describes Allegheny River spar rafts as well as the harvesting of spar timber in the immediate vicinity of Warren:

Obed [Stevens] did not belong to Pine Valley. The agents of the ship builders imported him from somewhere up the Allegheny. He rarely spoiled a mast in ‘falling’ a tree.

'Obed can lay 'em down like they was fallin' on a feather bed...' (quoted in Evanetski, n.d.:20).

It is likely that spars from the Allegheny watershed were rafted to ship builders in New Orleans, since that was the nearest downstream deep water port. However, no explicit references were identified.

Boats: The boats, called arks or barges, were manufactured and used within the Lumber Heritage Region. Generally, the boats were rectangular and flat-bottomed with dimensions from 16-20 feet wide and 60-90 feet long (Frank, 1972.). Flatboats measuring 26 feet by 170 feet were also built, specifically to transport sawed lumber (Cook, 1997). As indicated above, manufacture of boats was a major industry within the Allegheny watershed; numerous sawmills specialized in this, sending arks, barges, and flatboats to downstream markets loaded with lumber, where both the lumber and boats were sold (Casler, 1976; Cook, 1997). Frequently, it was hardwood lumber that was shipped in this fashion because it lacked the buoyancy required for rafting. Mine props and shingles, as well as grain and other non-lumber agricultural products, were also shipped in boats (Frank, 1972; Colcord, 1995). In the 1860s, for example, agricultural products were shipped by boat from the upper reaches of the Allegheny to be sold in the oil fields of Venango County, then barrels of oil were loaded to be delivered to a refinery in Pittsburgh. The boats themselves were sold along with the to carry coal and other bulk products further downstream (French, 1995). On the West Branch, arks were used by log drive crews, as described below. Arks, barges, and flatboats were unpowered, and like rafts, floated on the current, being steered in the same manner (Cook, 1997; Frank, 1978; Colcord, 1995).

Rafting and Raftsmen

On all the rafting streams of the region, there was an upstream point above which there was insufficient water for rafting. This was called the head of navigation. On the upper reaches of the West Branch, this point was about three miles above Cherry Tree. On Clearfield Creek it was at Irvona, and on Chest Creek it was near the Clearfield-Cambria County line (Frank, 1972.). On the upper reaches of the Sinnemahoning, the head of navigation was at what is now Costello, and on the Bennett Branch, it was at Caledonia (Huntley, 1936). Generally, half rafts were run on the upper reaches of streams, and on West Branch timber rafts, a crew of six ran each half raft. A pilot and two crewmen worked the front oar, while a steersman and the remaining two crewmen worked the stern oar (Frank, 1972.). The 16 feet by 16 feet "pieces" of an Allegheny River lumber raft were manned by crews of four, with two men on each oar (French, 1995). On the West Branch, the two half rafts were usually jointed to create a full raft in the large eddies below Buttermilk Falls. After the half rafts were joined, the crew of one returned to the upstream rafting-in ground to bring down another raft, while the crew of the other continued downstream with the full raft (Frank, 1972.). On the Allegheny, timber rafts were commonly roped together to form fleets of four full rafts, often accompanied by a flat boat with crew accommodations, when they reached the main stem of the river. The numbers of men required to man the various sized "fleets" of timber and lumber rafts on the Allegheny are not explicitly described (Colcord, 1979; 1995; French, 1995; Beebe, 1934).

There were three rafting divisions on the Susquehanna. Division I extended from the Kinsport Dam in Clearfield to Lock Haven. Division II was from Lock Haven to Marietta and Wrightsville, and Division III was from there to Port Deposit, Maryland at the beginning of tidewater on the Chesapeake. At each division, the change in river conditions required new pilots and crews who knew the down river hazards. During the early period of rafting, when rafts were sold at their final destinations, the pilots and crew members only means of returning to their homes was by walking. When canals were constructed, the packet boats provided transportation a portion of the way. However, when the railroads replaced the canal systems, the raftsmen returned up river by rail (Frank, 1972.).

On the West Branch, raft pilots navigated by rafting points, which were named and recognizable landmarks along the river, and assisted in recognition of location and hazards. Frank (1972) and Tonkin (1958) have documented rafting points along the West Branch, and these are included in the inventory. Similar navigation systems presumably existed on the other rafting streams of the West Branch drainage. It seems likely that this was true of the Allegheny as well.

As in pioneer times, building and running rafts continued to be a part-time adjunct to the agricultural economy of the region, and many raftsmen ran only a few rafts a year. With the development of the lumber industry and the increasing market for lumber products, however, some raft builders became specialists. One such, T. S. Shafer, is described as the greatest raftsman of the Sinnemahoning drainage, putting in 20 to 40 rafts per year, typically of oak, with pine comprising a third of each raft (Huntley, 1936). Running rafts was a specialty with set wages for both pilots and crewmen. Early in the rafting period, raftsmen received 50 cents per day. In later years, they were paid by the trip, and on the West Branch, for example, pilots made \$40 per trip from the headwaters to Marietta, while crewmen made \$30 per trip (Frank, 1972; 1978). In the 1860s, raft pilots on the Redbank made \$20 per trip from Brookville to the mouth of the creek at its confluence with the Clarion River (Scott, 1888).

Spar raftsmen in particular were noted for their exploits. In the upper West Branch drainage, the spar rafting industry was initiated in the 1830s by John Patchin, who became known as the Spar King (Tonkin, 1958; Frank, 1972). John Chase was his partner for a time, but after the two split, Chase came to specialize in both spar and timber rafts (Frank, 1972). Within the Sinnemahoning drainage, well-known spar raftsmen included John Brooks who operated on Bennett Branch between 1865 and 1872, and J. S. Wiley who is described as putting in spars on "...Four Mile Run on the Portage, which he ran to Marietta" (Huntley 1936:99).

On the Allegheny, the rafting industry was stimulated in 1850 by the first "lumber famine" in Pittsburgh. Due to low prices and unfavorable water conditions, few rafts arrived in Pittsburgh in the spring of that year and lumber prices increased dramatically. In November, substantial floods and the higher prices brought in many rafts, which sold for as much as \$18 per 1000 board feet for clear pine and \$9 per 1000 board feet for common pine (French, 1995). During the Civil War, rafting of lumber products flourished due to wartime demands. White oak, in particular, was needed for shipbuilding as navies expanded in both the north and the south. In addition, timber rafts supplied downstream sawmills on the main stem of the Susquehanna at Northumberland, Dauphin, Middletown, Columbia, Wrightsville, Little Washington, Harrisburg,

New Cumberland, and Port Deposit. On the Allegheny, timber rafts supplied sawmills along the length of the river and in Pittsburgh, Wheeling, Cincinnati, Louisville, and New Orleans (Frank, 1972). Demand continued to be high in post-war years due to a boom in the construction industry (Ross, n.d.).

Lock Haven became an important market for timber rafts on the West Branch. Here, 3000 to 4000 rafts were sold each year to sawmill owners and timber brokers. Since they all tended to arrive in the spring of the year, the market often became glutted, and speculators bought up rafts at low prices from "mountaineers" who needed to return to their farms and could not wait for a more favorable price (Huntley, 1936). Marietta also became an important market for timber rafts, since it was there that rafts stopped to change crews (Frank, 1972). The economic importance of timber rafting on the West Branch is evidenced by the numbers of rafts that were run to Lock Haven and other markets per year. Between 1840 and 1890, an average of 2000 rafts were floated out of the headwaters of the West Branch in Clearfield County in a year (Hall, 1925). This number was at least doubled by the contributions coming out of the various downstream tributaries. Collectively, West Branch rafts contained 150,000,000 to 300,000,000 board feet of lumber per year, on the same order of magnitude as that sawed in the Williamsport mills (Frank, 1972; Huntley, 1936). Interestingly, the sawmills at Williamsport did not purchase timber rafts, but were supplied exclusively by the log drives into the boom, and later by rail during the logging railroad era (Frank, 1972; Taber, 1995).

Navigation Companies

Within the Allegheny watershed, Redbank Creek and Mahoning Creek were two rafting streams that were especially difficult to navigate, and were improved through the creation of navigation companies. Attempts to improve the Redbank had been made as early as 1817, when an act of the Pennsylvania Assembly appropriated \$1000 for this purpose. A second act in 1838 declared the Redbank and Sandy Lick public highways (Scott, 1888). In the 1850s the navigation companies were formed. Termed the Redbank Navigation Company and the Mahoning Navigation Company, both were chartered by act of legislature (1854 and 1858 respectively), and both were empowered to collect tolls from rafts and arks, to defray the costs of building and maintaining the needed improvements (Scott, 1888; Kline, 1975). Specifically, the Redbank Navigation Company's charter empowered the company to:

...clean and clear the Redbank, Sandy Lick, and North Fork from all rocks, bars, and other obstructions; to erect dams and locks; to bracket and regulate all dams now erected; to regulate the schutes [sic] of dams; to control the waters for the purposes of navigation; to levy tolls not exceeding one and one quarter cents for every five miles of improved creek, per thousand feet of boards or other sawed stuff, for every 50 feet, linear measure, of square or other timber (Quoted in Scott, 1888:402).

The key to rafting on these two streams was the use of what were termed bracket dams. These functioned like splash dams, but were constructed on the main route of navigation and were built differently. A bracket dam consisted of an earth and wood reinforced dam with one or several sluiceways for the passage of rafts. These were U-shaped and lined with wood, and were closed

with a gate constructed of upright timbers with planks laid across them. The gates were held by a large timber running along the breast of the dam, and could be opened to create an artificial flood (Kline, 1975). Before the creation of the navigation companies, lumber rafts on the Redbank and Mahoning were limited in size to approximately 20,000 board feet. Afterwards, they increased to an average size of about 50,000 board feet (Scott, 1888). The effect of the improvements is evidenced in the quantities of timber products that were rafted out of these streams. In 1854 (the date of the Redbank Navigation Company's formation), approximately 20,000,000 board feet of lumber and 13,000,000 board feet of square timber were rafted out of the Redbank. By 1866, 44,000,000 board feet of lumber and 54,000,000 board feet of square timber were rafted out. Production continued to increase during the 1870s. On the spring flood of 1869, there were 74 board rafts and 350 timber rafts. On the 1872 flood, there were 570 board rafts and 917 timber rafts (Scott 1888).

Sometimes the creek was so full of rafts that some were crowded out of the channel. There sometimes formed a gorge, or jam. Then at the mouth of the creek there was sometimes the greatest of all jams, and as there was sometimes a thousand men there and accommodations for only half of them, the night was filled with drinking, and the cares that infested the day folded their tents like the Arabs and silently flitted away (Scott, 1888:585).

A navigation company was also created to deal with the difficulties of Bennett Branch. Termed the Bennetts Branch Improvement Company, it was formed by timber owners along Bennett Branch, who were also owners of Williamsport sawmills. Clearly formed to facilitate log drives, the company's improvements also enhanced rafting. In 1871, it built a large splash dam at Doctor's Rocks, near Benezette. This was followed by improvements to the channel and a second splash dam 10 miles further upstream at Slabtown. Prior to these improvements:

Bennett's Branch would not admit running large rafts. After the dam had been used for several years in driving logs, the stream had become wider. In the meantime the Improvement Corporation had improved the channel. Owing to the improved and wider stream, rafts of six platforms could be run (Huntley, 1936:478).

Sawmills and Log Drives

Jobbers: The standard arrangement by which lumber companies cut and transported logs to mills was by contracting with jobbers. Typically, a jobber would contract to cut one or several tracts offered by the company, with the responsibility for felling the trees, bucking them into logs, peeling the bark, and delivering the logs to the creek bank (Taber, 1995). The jobber would, in turn, hire a crew of lumberjacks to perform these tasks, and would be responsible for establishing a camp for them, supplying the camp with provisions, overseeing the work, and ultimately, paying them for the work that they had accomplished. In general, the contracts offered by the companies were not bid, but were offered on a "first come, take it or leave it at the given price" basis (Taber, 1995).

On the West Branch, some jobbers specialized in all phases of timbering operations with their felling and bucking crews, and teams and teamsters who transported logs removed of bark by ground and log slides to the West Branch and stream landings. Other jobbers specialized in driving the logs to the booms (Taber, 1995; Frank, 1972). Neither, however, got paid until the logs were delivered to the boom. Mill owners often found ways to cheat jobbers, who were occasionally ruined by this, having fronted the entire cost of the lumber camp or the log drive (Beebe, 1934). The crews hired by jobbers were not paid until after the jobber got paid (Huntley 1936).

Typically, jobbers worked for only one lumber company at a time. Some, however, took contracts from several and ran multiple crews. Leeson (1890) provides information on jobbers operating in Shippen Township in Cameron County. One jobber, the firm of Cochran Bros., was by far the largest operating there. They had contracts from five different lumber companies to cut multiple tracts and in one season "put in" 27,000,000 board feet of logs. Next largest was Reading, Fisher and Co. who only worked for one company and put in 8,000,000 board feet. The remaining jobbers in Shippen Township were Ardell, Mr. Williams, and J. A. Otto and Sons, all of whom worked for one company each, and put in from as little as "several thousands" to 8,000,000 board feet.

Booms: The lumbering industry of the entire West Branch drainage was transformed by the construction of the great log booms in the late 1840s and early 1850s. Tonkin (1958) credits the transition to "big business" logging and lumber production to the boom at Williamsport. However, the transition to large scale lumbering was well underway throughout most of the region by the time the booms were built; within the West Branch drainage, the process was hastened and enhanced by their use.

In Maine, log booms were common as early as the 1830s and before (Taber, 1975), so it is not surprising that the idea for the principal boom in the region, the Susquehanna Boom at Williamsport, is said to have originated with a Maine native. James Leighton visited the Susquehanna watershed in 1836, surveying the region's timber resources and seeking a suitable site for a boom. He was attracted to the Williamsport site for several reasons, including the "Long Reach" in the West Branch just upstream which provided a stretch of slow moving water with few obstacles for the storage of logs, and the existence of the Pennsylvania Canal for transporting lumber products to market. Despite efforts to promote the concept, he was unable to generate financing, and soon lost interest in the project. As the lumber industry in the region developed, however, other lumbermen including James Perkins and John DuBois promoted the idea of a boom at Williamsport, and in 1846, the Susquehanna Boom Company was chartered by the state legislature. The company failed to make progress, though, and in 1848, a competing company, the Loyalsock Boom Company, was chartered to construct a boom downstream, between Williamsport and Muncy (Taber, 1995).

Construction of the Susquehanna Boom finally began in 1850, and the first section of boom was operational in 1851. The impoundment pool created by the Big Water Mill's dam provided slackwater for its log storage and sorting functions (Taber, 1975). It consisted of piers of timber cribbing weighed down with stones, placed at intervals of approximately 200 feet within the river

and parallel to its bank, extending several feet above flood stage. Between the piers, timbers were chained end to end to provide a floating barrier to corral logs. The boom consisted of a primary log storage area with large, heavy piers, heavy chains and timbers. Here, logs diverted into the boom were packed by the force of the flowing water. From the upstream end of the storage boom, a shear boom extended across the river at an oblique angle. Constructed of lighter piers and retaining timbers, the shear boom was designed to deflect logs into the storage boom. To allow passage of rafts and boats, there was a gate, consisting of a detachable section of retaining timbers. When a log drive arrived at the boom, the gate was closed, and the shear boom deflected the logs into the storage boom, where they were retained until sorted and delivered to the Williamsport sawmills (Taber, 1995).

As they were being cut in the forests, logs were stamped on both ends with brands registered to mill and timber landowners recorded at the courthouse in Williamsport, each logging crew using the brand of the owner for whom they were cutting. These brands allowed “boom rats” – the crews working at the boom (Tonkin, 1958; Frank, 1978) -- to identify which logs should be delivered to which mill. At the downstream end of the storage boom was a log sorting area, where logs were floated out of the boom and sorted by brand into temporary storage pens, each pen specific to a mill destination. The logs were then assembled into rafts, and conveyed by steam tug to the various mills along the river bank, or by teams of horses or mules to the mills located along the canal. Up to 150 men were employed by the boom company to sort and deliver logs. Initially, the company charged 50 cents per 1000 board feet for handling logs. As extensions, improvements, and repairs to the boom were made, the company increased their rates to recover costs, eventually charging more than \$1 per 1000 board feet. Anyone could run logs into the boom and if he was not a mill owner or contracted to one, the owner of the logs could negotiate sale of his logs to a mill or mills, and have them delivered accordingly (Taber, 1995).

With the completion of the boom, additional mills were built at Williamsport, and increased boom capacity was soon needed. In 1856, the Loyalsock Boom, also known as the Montoursville Boom, was finally built, and competition between the two companies began. In 1858 they merged, both parties recognizing the advantages of a monopoly on log drives. After this, the Loyalsock Boom functioned as an adjunct to the Susquehanna Boom, receiving logs destined for downstream mills as well as overflow from the main boom when it was full. Continued growth in Williamsport’s lumber industry necessitated further expansion of boom capacity, and in 1866 another boom was built by the company, upstream to the west of Linden. When more mills opened in 1867, plans were made to expand the main boom. This could not be achieved with the small impoundment pool created by the Big Water Mill dam, so the 8 feet 9 inches high Hepburn Street Dam was constructed, and the main boom was gradually extended upstream within its pool, as the need for boom capacity increased. In 1873, the Williamsport booms reached their maximum extent, comprising seven separate booms and approximately 400 timber crib piers, and extending for a total of nine and a half miles along the river. The main boom alone was seven miles long. The capacity of the facility was 300,000,000 board feet of logs (Taber, 1995).

Despite, or perhaps because of, its magnitude, problems with the boom were common. Breaks occurred frequently, often caused by floods. Improvements were repeatedly made to strengthen

the boom by increasing the size and height of the piers and timber and chain restraints. Boom breaks also occurred when drives arrived on lesser floods. When this occurred, the force of water was insufficient to pack the logs, and as a result, the storage boom would soon fill with floating logs and the excess would extend upstream. These logs were held back by the lighter shear boom, which lacked the strength for the extra capacity and would consequently break. Boom breaks resulted in massive loss of logs, the property principally of the Williamsport mill owners. Attempts to assess the boom company for damages from boom breaks were consistently unsuccessful. Despite these losses and other setbacks, Williamsport's lumber industry grew rapidly during the 1850s and 1860s, and the city came to contain the greatest concentration of sawmills and related industries in the United States (Taber, 1995).

Although the Williamsport boom was by far the largest, booms were also built at other locations along the West Branch. Built in 1849, the three-mile long West Branch Boom at Lock Haven was established two years earlier than the Susquehanna Boom (Linn, 1883; Frank, 1972). Between Lock Haven and Williamsport, there was a boom at Jersey Shore, and downstream from Williamsport, booms at Montoursville and Muncy received logs from Loyalsock Creek. A boom at Curwensville was the furthest upstream on the West Branch (Frank, 1972).

Although the larger booms such as those at Lock Haven and Williamsport were owned and operated by chartered boom companies and provided logs to numerous independent sawmills, smaller booms were built and operated by single lumber companies to supply their specific needs. This was true of the Curwensville boom, which was a part of the Curwensville Lumber Company and supplied its own sawmill. Similarly, Phelps Mills on Pine Creek is described as having "...excellent facilities for harboring their logs in extensive booms..." (Kraybill, 1991:127), and the 1885 flood in Elk County "...carried away 400,000 feet of logs from Hyde Mills at Eagle Valley, and ... Dickerson Bros. Boom further down..." (Leeson 1890:577). With the exception of the huge Williamsport boom, upstream booms were at a disadvantage to downstream booms, since the former had to remain open until the latter had finished receiving their logs. As a result, the Curwensville Lumber Company switched from its boom to a logging railroad as soon as practicable (Frank, 1972).

The principal effect of the use of the big log drives and log booms was to eliminate the need within the West Branch drainage for numerous large mills in upstream locations (Taber, 1972b). Instead, the large mills and the wealth they generated were concentrated where the booms were located, and these towns, principally Williamsport and Lock Haven, became the literal "boom towns" of the water transport lumbering era. They experienced explosive demographic and economic growth, the development of industrial and working class residential sectors, and residential enclaves for the elite comprised of the high-style residences of mill owners, speculators, and other successful capitalists.

Log Drives: With the construction of the Williamsport boom, the great log drives of the West Branch drainage started. Assembling a drive began, of course, in the forests where the timber was cut, trimmed of limbs, and "bucked" into saw logs. Prior to 1860, felling and bucking were both accomplished with double bitted axes. With the introduction of the cross-cut saw in the early 1860s, saws were used for the back cut in felling, and were also used for bucking (Frank,

1972). Lumberjacks specialized to some degree in these activities, with certain crews concentrating on felling and others on bucking. Other tools of the water era lumberjacks included peavies, wedges, sledge hammers, grabs, and skippers. A specialized tool unique to the period was the stamping iron, with which the timber owner's brand was hammered into each end of every log. Unmarked logs became the property of the boom company (Taber, 1995).

Before being transported, logs were stripped of their bark. Reportedly, removing the bark from logs began after the raftsmen/logger war, when raftsmen attempted to sabotage the mills at the booms by driving spikes or other pieces of metal into saw logs to damage the saw blades. Peeling the bark made this practice harder to hide. It was discovered, however, that logs without bark had other advantages as well, since the logs slid more easily on the log slides, did not jam as easily during the drive, and picked up less sand and silt (which dulled saws) while in the water than logs that retained their bark (Frank, 1972).

The logging camps set up by the jobbers usually consisted of a bunkhouse, a cookhouse and mess hall, a blacksmith shop, a saw sharpening shed, a barn, and an office (Frank, 1972). They differed mainly from the later railroad era camps in being more permanent and, as a result, more substantially built. Some even had gardens or a small farm. They were generally occupied for several years before the timber near them had been cut, and a move was necessary (Beebe, 1934). Conversely, camps of the railroad logging era were moved every year.

Normally, the logs were skidded to log slides by teamsters, and were then rolled into a log slide and towed along it by teams of horses. Reportedly the invention of John DuBois (Kline, 1975), log slides consisted of logs laid in two closely parallel lines, staked firmly in place. The sides of the logs facing inwards were then hewn by broadaxe to form an oblique V, into which the logs were rolled. Up to 40 to 50 logs were rolled into the slide, with small gaps between them. The team was hitched to the rear log, and started the line moving downhill, each log starting the one in front as it bumped into it. Teams moved the logs on the gentler slopes, but on steep slopes the logs ran free, sometimes at considerable speed. To facilitate movement of the logs, slides were often iced in the winter (Frank, 1972; Huntley, 1936; Taber, 1995; Tonkin, 1958).

Through the use of slides and skidding, the logs arrived at the banks of the nearest usable stream, where they were banked until the drive began. Streams used to move logs had to be cleared of obstacles, and splash dams built in series to provide sufficient flow to float the logs. Splash dams were gated, and opening the gate produced an artificial flood to carry the banked logs to a larger stream capable of floating the logs. From there the drive began, growing ever larger as more and more tributaries emptied their logs into the main stream.

The drive crew traveled behind the drive, generally in three arks built specifically for that particular drive. One ark housed horses, another the drive crew itself, and the third a cook house. The principal job of the crew was to float stranded logs off islands, bars and the banks of the river. When log jams occurred, expert jam crackers would free the jammed logs, allowing the drive to continue downstream. After the drive reached the boom, the arks were sold for use in downstream shipping, or were broken up and sold as lumber (Huntley, 1936; Taber, 1995).

Drives were run whenever there was sufficient water in the streams and the splash dams were full of water. Commonly, this occurred in early spring, late spring, and sometimes in early fall. The principal drive was usually in early spring, when melting snow water combined with rainstorms produced what was known as the "Easter Rise," usually one of the largest floods. At the end of winter, the booms were hung³ and the upstream jobbers notified that the drive could commence. When water conditions became favorable, the logs were floated, the splash dams opened, and the drive began. To the west of Lock Haven, there were three main sources of logs entering the West Branch: the upper reaches of the West Branch itself, Sinnemahoning Creek, and Bennett Branch. Lesser sources were Young Womans Creek, Kettle Creek, and Drury's Run. To the east of Lock Haven, the principal sources of logs were Pine Creek and Little Pine Creek. The main body of the drive generally lasted only four to six days (Taber, 1995).

Vagaries of weather sometimes resulted in substantial variability in the scheduling of drives, and this threatened delays and interruptions in the production of the downstream mills. In 1870, for example, no drive occurred until mid-April, when modest rises brought only enough logs into the Susquehanna Boom for the Williamsport mills to start cutting and continue operating for several months. To avoid shutting down, the additional logs that a substantial flood would deliver were needed. This did not come until early June, by which time a shutdown was becoming imminent for many mills and pressure on the jobbers to deliver logs was intense. With heavy early June rains, the rivers and streams rose, and jobbers floated their logs and splashed them down to the West Branch to join the main log drive as quickly as they could. The enormous drive that resulted came into the Williamsport boom within a period of a few days, and quickly filled it. The boom broke and approximately 8,000,000 board feet of logs were lost (Taber, 1995).

One of the largest drives in history occurred in the spring of 1884, when the main drive coming from the upper reaches of the West Branch was joined by 80,000,000 board feet of logs coming out of the Sinnemahoning, and 40,000,000 board feet more coming out of Kettle Creek. As was typical, numerous spar and timber rafts floated along with the main drive (Frank, 1972). How these massive drives were sorted and coordinated so as to supply both the Williamsport and the Lock Haven booms is not known (Taber, 1995). Perhaps the jobbers cutting for the Williamsport mills had priority, and floated their logs first. The Lock Haven jobbers might have then been notified after the main Williamsport drive had passed and the Lock Haven boom could be closed.

Even on the upper reaches of tributary streams there were substantial drives. On Pine Creek in Potter County, for example, drives contained as much as 15,000,000 to 20,000,000 board feet (Leeson, 1890). Although the West Branch drives were by far the largest, logs from the western half of Potter County were also driven down Oswayo Creek to booms and mills in New York State at Millgrove and Westons, and from there the lumber was shipped via the Genesee Valley Canal to Albany and New York City (French, 1995).

Logger/Raftsmen Relations: When they were introduced into the West Branch watershed, log booms and log drives were resented by the raftsmen. Floating logs and log jams were additional

³ To avoid ice damage, the chains and restraining timbers of the booms were dismantled during the winter. They were "hung" again in the spring after the ice was out of the river.

river obstacles and booms had to close when drives came in, stopping the rafts as well. Furthermore, loggers cutting saw logs for the mills took out all the trees 10 inches in diameter or larger. Since raftsmen only cut the larger trees required for square timber or spars, this practice threatened the rafters' future supply of timber (Taber, 1995; Frank, 1972; 1978). Tensions erupted in the "raftsmen/logger war" of 1857, when the first log drives were initiated in Clearfield County. A group of raftsmen attacked a logging crew that was cutting for the drive, and drove them off the tract they were working. The outcome of the ensuing court case was in the favor of the sawmill owners and loggers (Tonkin, 1958; Frank, 1972; 1978). Raftsmen also attempted to sabotage the mills by driving pieces of metal into logs to damage the saws. As described above, the loggers responded by removing the bark from the logs.

After these initial problems, however, raftsmen came to accept the drives and booms, and accommodation between the two competing systems developed. Although loggers initially cut indiscriminately, timber owners soon realized that monetary returns could be maximized by having raftsmen cut the more valuable spar and square timber trees first, and then selling the remaining timber to loggers to be cut into saw logs. Loggers and raftsmen also supplied different markets, and as a result were not in direct competition. Log drives supplied the logs to fill the six booms along the Susquehanna, since rafting could not deliver the volume of logs needed by the big mills. However, log drives limited the length of the lumber these mills could produce, since saw logs longer than 16 feet caused unbreakable log jams during the drive. Thus, the big mills could not effectively compete with the raftsmen in the production of long construction timber. As a result, rafting came to focus on supplying specialty markets for long timbers, and oak and spars for shipbuilding. The sawmills, in contrast, supplied the market for dimension lumber from 8 feet to 16 feet in length (the standard lengths of dimension lumber today).

Cooperation also developed between loggers and raftsmen in basic operating procedures. For example, when the river was too low for rafting, the raftsmen could collectively agree to pay the logging jobbers to open their splash dams, thus raising the river to rafting stage (Tonkin, 1958; Taber, 1972b; Frank, 1972; 1978). Cooperation also developed with respect to the operation of the log booms. Legally, the booms had no right to close the river, which was a public highway, and as a result, the booms had to be gated. When a drive arrived, the gates had to be closed to capture the logs, and this stopped any rafts that approached the boom as well. Booms also closed the river when there was insufficient flow to pack the logs, and they backed up, covering the river behind the shear boom. In these cases the boom company had to extend the storage boom upstream with a temporary boom structure to avoid losing the logs, and this also caused significant delays for the raftsmen coming down behind the drive. It was agreed that the boom company would pay the raftsmen damages for any such delays incurred, and after each such closure, these were negotiated between the two (Taber, 1995; Huntley, 1936). To accommodate the stranded raftsmen, where rafts could be tied hotels sprang up at the booms (Taber, 1995).

Saw Mills: Large scale industrial lumbering operations were made possible by critical innovations in the technology of sawmills. By far the single most important of these was the adaptation of steam power for use in sawmills. Water-powered mills, no matter how large, were limited in output by the amount of power their water wheels could generate. Even the Big Water Mill in Williamsport, the largest water mill ever built within the Lumber Heritage Region, had

far less output than a modest steam-powered mill of the era (Taber 1995). Initially, steam mills in the region used small engines of substantially less than 100 horsepower, and as late as the 1870s, mills with engines larger than this were not common (Taber, 1995). Steam power to operate sawmills in the white pine regions of the United States was introduced in 1832 (Cook, 1997), but steam mills do not appear to have been built in the Lumber Heritage Region until the 1840s: Beebe (1934) mentions a steam mill in 1844 in Hebron Township in Potter County. By the mid-1850s, though, the transition to steam power was well under way, with two steam mills in Potter County (Beebe, 1934), several in Williamsport (Taber 1995), at least two in Clinton County near Jersey Shore and Beech Creek (Linn, 1883), one at Brookville in Jefferson County (Scott 1888), and undoubtedly many more in other parts of the region.

Other key innovations in saw milling technology involved the saws themselves. The single-blade reciprocating sash saws of the pioneer era mills were replaced by multiple-blade gang saws, and later by circular and band saws. Although limited in size by metallurgical technology until the introduction of the Bessemer Converter in 1872 (Ross, n.d.), circular saws were being introduced into the region's mills as early as the 1850s (Groenendaal and Jones, 1998). With the introduction of the band saw in the 1880s, the big mills of the period developed into their final form. Band or circular saws were used for initial cuts that squared a log before it was routed to a gang saw to be sawed into dimension lumber. Band saws in particular were large, measuring 8 inches deep by 30 feet long. Initially toothed on one side only, they were later toothed on both sides, and could cut a log on the run and the return of the log carriage (Taber, 1995).

A fully-evolved sawmill of the period was normally built on two levels, with the steam engine on the first floor and the saws on the second. This allowed the finished lumber to be stacked more easily, and the stacks of lumber in the yards of late nineteenth century mills often reached heights of 24 feet. The boilers that generated steam for the engine were usually located in a nearby but separate building, with a brick wall between the two for safety from fire. Depending on the size of the engine, from two to four boilers were needed. As logs entered the mill on jack slips, they were routed first to band or circular saws to be squared. If it was to be cut into boards, the squared timber was routed to a gang saw with up to 30 blades, which cut the entire stick into boards in a single pass. If it were to be used as square timber, the stick would be sized and routed to the yard for stacking. Other saws that might be present included those for lath and pickets, as well as edgers and planers. The Phelps and Dodge mill in Williamsport, the largest in the city, had four jack slips, three single band saws for initial cutting, five gang saws for boards, and saws for both lath and pickets (Taber, 1995).

Mills that depended on water transport to receive their logs generally operated for seven months of the year. They closed in late fall or early winter when the log ponds and the canal froze, rendering both operation and transport of products infeasible. They resumed cutting in early spring, after the first logs arrived in the booms (Taber, 1995).

The crews in the Williamsport mills worked eleven and a half hour days, and throughout the region, a workday of approximately 12 hours was common. During the winter layoff, mill workers generally joined the crews cutting timber in the woods, and worked for the jobbers under contract to the mill owners (Taber 1995).

Although the booms for obvious reasons tended to concentrate milling operations in their immediate vicinity, it is notable that large mills also were built within remote upstream portions of the West Branch watershed, where the big drives and booms could not have supplied them with logs. Linn, for example, describes two mills near the mouth of Beech Creek in Clinton County, and indicates that both were "decided improvements" on those that were built before, having circular saws, an edger, and "much greater capacity" (Linn 1883:579). Another cluster of mills was about one-half mile above the mouth of Beech Creek. Here in 1855 or 1856, a large water mill was built, with an annual capacity of 4,000,000 board feet. A few years later, a steam-powered planing mill was constructed. When this mill complex was destroyed by fire in 1864, a new mill was immediately built, with "...three gangs of saws, a muley saw, an edger, and lath and planing mill...the whole driven by an eighty horse-power [steam] engine" (Linn, 1883:580).

A second cluster of large mills was situated along the West Branch just below what is now Renovo in Clinton County. Here, there were three large steam mills, one at the mouth of Paddy's Run (built in 1863), another a quarter of a mile up Young Womans Creek (built in 1872), and a third two miles above Hyners Run (built in 1872; Linn, 1883). Further downstream, there was a large mill on Tangascootac Creek just above its mouth, with a daily capacity of 35,000 board feet. A water-powered shingle mill was associated with this facility (Linn, 1883). Another cluster of large mills was located in the upper Sinnemahoning drainage, with extensive mills as early as 1849 at Sinnemahoning, Sterling, Cameron, and near Emporium (Leeson, 1890).

How these upstream West Branch mills operated is not well documented. Presumably, they received rafted logs and timber as did, for example, many of the mills at Lock Haven. They may also have splashed logs down the creeks they were located on, as did the Allegheny watershed sawmills of the period. Presumably, the mills near Beech Creek shipped their output to markets via the Bald Eagle Extension canal, since all were either adjacent to it or only a short wagon trip distant. The mill on Tangascootac Creek may have had access to the head of navigation on the Western Division canal at Farrandsville. How the other mills, which were remote from canals, shipped to markets is unclear. The obvious solution was via lumber rafts, but sources claim that these were not used in the West Branch drainage after completion of the Western Division canal (Taber, 1972b), and lumber rafts had a decided disadvantage compared to canal transport, since the boards arrived covered with mud and silt, which dulled tools.

In contrast to the West Branch, the Allegheny watershed was not served by canals nor until the latter portion of the water transport period, by railroads. Here, lumber rafting constituted the principal means of transporting dimension lumber to market, and lumber rafts, as indicated above, reached enormous size. Lacking large log booms such as those at Williamsport and Lock Haven, the lumbering industry of the Allegheny watershed remained dispersed, with the mills generally located within or near the timber lands the mill owner or jobber was cutting or expected to be cutting. Here, at least one method of moving logs to the mills employed log slides and skidding to transfer them to streams and splashing them downstream to mills, which were frequently located near the mouths of the streams. Wessman (1981), for example, describes log slides, splash dams, and log drives being used to float logs down many Elk County streams, and Taber (1974) indicates that the mill that Joseph Hyde built at Portland Mills in 1856 was

supplied by logs floated down Little Toby Creek and the Clarion River. It seems probable that, as with at least some mills in the West Branch drainage, Allegheny drainage mills had small booms to catch the logs coming downstream and for log storage. Other methods employed on the Allegheny included hauling logs overland by teamsters and presumably, delivery to mills of log and timber rafts.

Examples of Allegheny drainage log delivery systems are described by Casler (1976) for several mills of the Salmon Creek Lumber Company at Kellettsville:

A sawmill was built on Salmon Creek at a point where The Branch joins it about a mile upstream from Tionesta Creek. Its location was ideal for the floating of logs on both Salmon Creek and The Branch by using dams to supply sufficient water. The timber was within easy access to these streams. But the finished lumber had to be hauled by team about a mile to the bank of the Tionesta Creek where it was made into rafts to go down the Allegheny River (Casler, 1976:127).

At another mill, a similar method was attempted, but was less successful due to lack of reliable flow. As a result, logs had to be hauled to the mill by teams (Casler, 1976). A similar system is described by Taber (1974) for the mill of C. T. Wheeler at Laurel Mills, just below Ridgway. This mill, built in 1879-1880, was situated about two miles up Big Mill Creek from its confluence with the Clarion River. On Big Mill Creek were three splash dams for moving logs to the mill. Additional evidence for the pervasive use of splash dams to move logs is the description of the lower portion of Bear Creek in Highland Township, Elk County as having been entirely logged by splash dams (Taber, 1974). The lumbering operation of John DuBois in Clearfield County at Dubois was also structured in this way. He built several mills at Dubois in 1872 and 1873, and to supply them he made extensive improvements to Sandy Lick Creek and its tributaries, including straightening channels and constructing 30 splash dams (Kline, 1975). Similarly, the Cook operation at Cooksburg used bracket dams on Tom's Run as splash dams to supply their mill (Cook, 1997).

Allegheny drainage mills that produced dimension lumber were similar in size and internal operation to those of the West Branch, described above. However, the lumbering industry of the Allegheny differed from that of the West Branch in that ark and boat building was an important industry conducted as an integral part of sawmill operations, and this placed special demands on the mills (Casler, 1976). An example was the operation of Truman (Teddy) Collins, who between 1854 and 1860, purchased several tracts of timberland and sawmills in the Beaver Creek watershed, and began cutting white pine for building lumber rafts and boats. Initially, logs were hauled to his mills by teams, and most of the lumber he manufactured was rafted downstream to Pittsburgh and Cincinnati. A large amount was also used in the construction of barges and boats (Casler, 1976).

In 1870, Collins bought 7000 acres of timber land on Tionesta Creek, and built a new mill at Nebraska that illustrates the special needs of the boat and barge building industry. The mill contained a water-powered circular saw and a special tandem carriage specifically designed and constructed to handle the logs needed for barges, which were up to 100 feet long. In 1887, the

mill was improved; a band saw was installed to cut saw logs, and the circular saw for boat timbers was converted to steam power (Casler, 1976). Collins' lumbering operation continued to be successful throughout the water transport and railroad logging eras, and is described more fully below.

Speculators and Sawmill Owners: Also critical to the development of industrial lumbering were individuals with sufficient capital to acquire the large tracts of forest land needed to keep the big mills cutting. Along with steam power and the construction of log booms, the 1850s witnessed the development of a banking system within the more developed portions of the region that was capable of extending substantial credit to timber land speculators, thus facilitating their acquisition of large tracts (Tonkin, 1958). Typically, large saw milling operations were run as partnerships, with one partner owning and operating a mill and another owning timber land and/or acting as sales agent (Taber, 1995). As industrial lumbering started to generate significant profits, mill owners themselves were increasingly able to acquire the timber lands they needed, and began buying up huge tracts of white pine (Beebe, 1934; Frank, n.d.). In the West Branch drainage, the mill owners in Williamsport were especially aggressive, and one of the most aggressive of these was Phelps, Dodge and Company, owner of the largest mill in Williamsport (Beebe, 1934). Throughout the era, the mill owners attempted to regulate the amount of the lands that they cut, based on remaining stocks in their yards at the end of a season's cut. When large amounts of unsold lumber remained, they would cut back on the next year's harvest by reducing the number and size of tracts they hired jobbers to cut (Taber, 1995).

Williamsport

Due to the Susquehanna Boom, Williamsport came to have the largest concentration of sawmills in the United States during the nineteenth century. Even before the boom was completed, new sawmills were being built there in anticipation, and by the end of 1851, three new, steam-powered mills had been constructed. Nine more were built between 1852 and 1854. In 1855, the Sunbury and Erie railroad reached Williamsport, providing an additional transport facility for lumber products. By 1859, there were 18 sawmills, three or four planing mills, two sash and door factories, and two furniture companies in the city (Taber, 1995).

Explosive industrial growth continued during the 1860s, with seven new mills finished between 1860 and 1866, and another seven in 1867. In 1863-1864, Phelps, Dodge and Company built their new mill, by far the largest in the city. The Phelps, Dodge mill employed 74 men initially and cut 100,000 board feet a day. By 1867, its capacity had been increased to 150,000 feet per day and, including an associated planing mill, the company employed 200 men. An associated company town called Dodge Mills was established, consisting of a row of houses along Arch Street for married mill workers and their families. With the growth in industry, Williamsport's population grew rapidly as well, more than tripling during the 1850s, and nearly tripling again in the 1860s (Taber, 1995).

Williamsport also grew as an important center of flooring, furniture, veneer, and wooden pipe manufacturing. Some companies established during the 1860s and 1870s, such as the Williamsport Furniture Company, remained in business well into twentieth century. Specialty

companies such as Castner Picture Frames and the Standard Wood Pipe Company were renowned for their wood products (Norris, 2000).

Williamsport's economic growth slowed dramatically in the 1870s. Although almost 300,000,000 board feet of lumber were cut there in 1872, sales were slow, and at the end of the year unsold lumber stocks in the yards of the mills were huge. Williamsport's peak production year was 1873, when 1,582,460 logs were sawed and 318,342,712 board feet of lumber were produced (Taber, 1995; Painter, 1925). After the panic of 1873, however, lumber sales were slow, and Williamsport's mills started to go bankrupt. Six mills failed between 1875 and 1878, and others shut down to await more favorable economic circumstances (Taber, 1995).

Williamsport's lumbering industry experienced resurgence in the 1880s as prices for pine lumber rose, and hemlock became profitable to cut. Although no new mills were built, existing ones were expanded, and the mill and boom owners made huge profits. It was this period of prosperity that is principally reflected in the high style mansion architecture of "Millionaires Row." By 1900, however, the industry again went into decline, as timber resources accessible to streams became depleted and the focus of the lumber industry turned to Michigan and Wisconsin. After 1900, each year saw one or two mills close, and the number of logs processed by the boom dropped steadily at first, then precipitously. After 58 years of use, the boom finally closed in 1909, and the last log was sawed in a Williamsport mill in 1919 (Taber, 1995).

Other Lumber Towns

Throughout the Lumber Heritage Region, towns were founded and grew in response to the development of industrial lumbering. Some disappeared entirely with the early twentieth century decline in the lumber industry, and are today only ghost towns. Others are only a fraction of their previous size. Like Williamsport, still others diversified economically and continued as industrial and commercial centers of the region. The lumbering origins of several communities are briefly described below.

Lock Haven: Like Williamsport, albeit on a considerably smaller scale, Lock Haven's lumbering industry was initiated by the construction of the West Branch log boom in 1849 (Taber, 1995). Enumerations of the buildings in Lock Haven in 1838 and 1844 include no sawmills or related industries (Linn, 1883). But after the construction of the boom,

“...the rapid growth of Lock Haven commenced. Property doubled, trebled, and quadrupled in value, and soon the fields around the town were dotted with houses and the streets filled with an industrious, energetic, and prosperous people...” (H. L. Dieffenbach, quoted in Linn, 1883:542).

When lumbering was at its height, there were at least nine large mills in Lock Haven and its vicinity, with a cutting capacity of 100,000,000 board feet a year (Frank, 1972; 1978).

Unlike Williamsport, Lock Haven was a center of the timber rafting industry. Probably because it was the furthest upstream port of any size on the Western Division canal, rafts coming down

the West Branch and its tributaries collected at Lock Haven, where raft brokers purchased them from the raftsmen. Raft timber was shipped from Lock Haven to markets via the canal until the canal was damaged, circa 1889. Alternatively, speculators would purchase rafts at low prices at Lock Haven and hold them there until prices rose, or run them downstream in fleets, seeking higher prices in downstream markets. Many rafts arriving at Lock Haven were also sold to the town's sawmills, providing them an alternative to the boom as a source of supply (Frank, 1972; 1978).

As late as 1883, Lock Haven's industrial base was still dominated by the lumber industry. "Of the various industrial establishments now in successful operation, those for the manufacture and working of lumber are the most important" (Linn, 1883:533). With the establishment of the Pennsylvania Pulp and Paper Company (later Hammernill), Lock Haven became an important center for the manufacture of paper products in the twentieth century.

Warren: The first permanent structure at the site that is now Warren was built by surveyors working for the Holland Land Company in 1796 as storage for their equipment (Evanetski, n.d.; Schenck, 1887). Additional buildings followed with the first permanent settlers, but the community remained a small village during the first decade of the 1800s. Growth began with the rise of the lumbering industry in Warren County, which, as indicated above, began there at a relatively early date. As early as 1829, Warren contained 50 residences, five stores, three taverns, two tanneries, two sawmills, a grist mill, and various craftsmen, lawyers, doctors, and other business people. (Schenck, 1887). In 1832, it was made a borough, and in 1834 its first bank, appropriately named the Lumbermen's Bank, was incorporated. During the decade of the 1840s, the town was "...slowly increasing in population as a result of being the commercial center of a lumbering region" (Schenck, 1887:340). Although the Lumbermen's Bank failed in the panic of 1838, new banks were established in the 1850s. Unlike Williamsport and Lock Haven, Warren's economy diversified at a relatively early date, as additional industries were established there. Some of these were lumber-related, including a sash and door factory (1856). Others were not obviously related to lumbering, such as a foundry and machine shop (1851), and an additional foundry (1856) that manufactured stoves and other household items. Industrial growth and diversification continued during the 1860s, and in 1867-1868, many new buildings were erected, "...both dwellings and businesses, of a size and ornate style of architecture to this time here unseen" (Schenck, 1887:345).

In the 1870s, Warren became a commercial center of the oil industry, and continued to grow and diversify. In 1870, it had 2001 inhabitants; by 1887, it had grown to approximately 5000 (Schenck 1887). With a substantial population and diversified economy, Warren continued to be one of the region's larger cities into the twentieth century.

Ridgway: On the upper reaches of the Clarion River, Ridgway was an early center for rafting (Wessman, 1981). The town was laid out in 1833, at which time there were seven families living there. Its early economy was dominated by the lumbering industry, and the Hughes, Dickinson, and Company sawmill was one of the first businesses there. Tanning was also an important early industry. The first tannery in Ridgway was erected in the early 1830s. In addition to the tannery and the Dickinson sawmill, there were 13 residences, two schools, a gristmill, three hotels, three

stores, a stable, a blacksmith shop, and the courthouse in Ridgway in 1846. In the 1850s, additional stores and residences were built in response to an influx of Swedish and Italian immigrants (Wessman, 1981), probably arriving to work in the lumber mills and camps of the area.

Additional tanneries were built in Ridgway shortly thereafter, including the Grant-Horton Tannery (the Ridgway Tannery) built in 1867, and the Eagle Valley Tannery, built in 1870. Other lumber-related industries of the period included the Ridgway Planing Mill, built in 1866. In the 1870s, Ridgway's economy began to diversify with the establishment of the Ridgway Iron Works in 1875. In the early 1880s, the W. H. Hyde and Company lumber company was established there, to manufacture hemlock, pine, and hardwood lumber, as well as lath. In the 1880s and 1890s, additional lumber-related industries included several wagon works, an axe and tool company, and a railroad car and snow plow manufacturer. Non-lumber industries included a lamp black company, a cigar factory, and edged tool company, a beef company, a brick company, and others (Wessman, 1981). Like Warren, Ridgway continued throughout the twentieth century as one of the region's larger cities.

Tanneries and Hemlock

Hemlock had little economic value until the late 1870s and early 1880s, since before then, there were few large tanneries needing hemlock bark to extract tannic acid, and hemlock lumber was worth only about half as much as pine lumber (Taber, 1995; Beebe, 1934). This changed with the establishment of the first large tanneries and the late nineteenth century rise in the value of hemlock lumber. As early as 1874, a sawmill built at Keating Summit in Potter County was one of the first to saw hemlock commercially, for use as heavy timbers for railroads. By 1879, hemlock logs were being run to Port Allegheny, and one sawmill reportedly had 4,000,000 board feet of hemlock in the river at Roulette (Beebe, 1934).

Although normally associated with railroad logging, hemlock also became increasingly important in the great log drives of the West Branch and in the lumber sawed by the Williamsport and Lock Haven mills. Between 1881 and 1883, the percentage of hemlock cut by Williamsport mills increased from 16 to 32 percent, and by 1890, had exceeded 50 percent. Hemlock continued to be sawed in ever greater percentages, until by the mid 1890s, it comprised nearly 90 percent of mill output (Taber, 1995).

At the same time that hemlock lumber became commercially viable, large tanneries were also built throughout the region in response to a nationwide increase in the need for leather. This provided an additional stimulus for hemlock lumbering. Leather was needed primarily for machinery belts in industry. The primary drive of a typical late nineteenth century, steam-powered factory was provided by a leather belt that could be as large as two to three feet wide, one-half inch thick, and 70 feet long. In addition, every piece of machinery within such a factory was driven by a smaller belt, taking power from the main drive (Taber, 1995).

As noted above, tanneries were built in Ridgway in 1867 and 1870. In Potter County, the first large tannery was built at Oswayo in 1877-1878, and additional ones were constructed in

Coudersport and Pike Mills in 1880. Large tanneries were built in Harrison Valley and in Costello in 1881, and at Shinglehouse in the mid 1880s (Beebe, 1934). Other counties in the region also witnessed the establishment of tanneries at about the same time.

To supply the new tanneries, bark peeling became a major industry. After felling, hemlock trees were circled with a cut every four feet, and the bark was peeled in these four-foot sections. It was left on the ground for several days to dry, and during the Timber Rafting Era, was hauled to tanneries in wagons (Taber 1995). The heyday of bark peeling and the tanneries, though, came a few decades later, with railroad logging.

Decline of Water Transportation

The decline in white pine lumbering and water transport of lumber products at the end of the nineteenth century is attributable to the depletion of the white pine forests and the ascendancy of railroad logging. As early as the 1870s, the exhaustion of white pine was being widely predicted, and by 1880, many contemporary observers believed that pine had been exhausted throughout the entire region. In Potter County, for example, pine lumbering in the 1870s was perceived to be "still brisk in many sections of the county," but clearly coming to an end (Beebe, 1934:174). Taber (1972b) points out, however, that the actual exhaustion of pine came more than two decades later, since 221,000,000 board feet were cut as late as 1900. This was from isolated trees, however, since the dense tracts of pine had all been cut by the early 1890s (Beebe, 1934).

With the depletion of white pine, the rafting of spars and timber came to an end. The last spars on the Sinnemahoning were put in at Sterling Run in 1883, and the last timber rafts were run down the Sinnemahoning in 1915 (Huntley, 1936). In 1917, the last commercial rafts of the entire West Branch drainage were run (Frank, 1972; 1978). Although the details are less well documented, pine lumbering within the Allegheny watershed is also believed to have ended during the first two decades of the twentieth century (Kline, 1976). The last commercial rafts went down the Clarion River in 1921 (Frank, 1972; 1978).

The development of railroad logging brought the era of the great log drives and log booms to an end. Railroad logging had significant advantages, since it could continue during the winter months and could deliver logs to mills more predictably and reliably. Constructing splash dams and clearing streams were also expensive (Taber, 1972b; 1995). Probably the most important factor favoring railroad logging, however, was its ability to access timber that was remote from streams, since that was mostly all that was left by 1900. The last pine sticks were taken out of the Cush Cushion watershed, for example, in 1894, and the last hemlock log in 1900 (Tonkin, 1958). Beginning in the 1890s, the Williamsport mills received more and more of their logs by railroad until, by 1906, half of the mills received all or a portion of their logs in this fashion (Taber, 1995). In 1903, the last log drive on Driftwood Branch was run (Huntley, 1936), and in 1907, the Williamsport boom received its last log drive of 50,000,000 board feet of logs (Frank, 1978), before closing completely in 1909 (Taber, 1995).

Unable to compete with the huge mills being built throughout the region in conjunction with logging railroads, the Williamsport mills began to close. By 1905, there were only four mills

operating in the city, and by 1910, there was only one. It continued to cut until 1919, when it too sawed its last log (Taber, 1995).

Property Types of the Timber Rafting Era

Potential property types for this context include sawmills of various types (water-powered, steam powered, sash, circular, band, etc.) skid roads, navigation dams (including bracket dams and slackwater dams), splash dams, company towns, logging camps, log slides, log booms, log ponds, rafting-in grounds, heads of navigation, rafting points, tanneries, haul roads, and urban historic districts. The locations of ten Timber Rafting Era sawmills were identified during the inventory, situated in Jefferson, Cambria, Clinton, Clearfield, and Warren Counties. Of special note is the John Patchin House and sawmill in Clearfield County. Eleven splash dams of the era were found, in Warren, Potter, Indiana, Lycoming, Centre, Clinton, Clearfield, and Cambria Counties. Some are extant; the condition of others is unknown. The company town associated with the Phelps and Dodge mill in Williamsport is no longer extant (Taber 1995). Cobbtown is a Timber Rafting Era ghost town in Clarion County. No other Timber Era company towns were found. Remains of the Susquehanna Boom are visible in the river upstream from Williamsport. Two log ponds were found, one in Warren County and the other in Indiana County. Six rafting-in grounds were identified, one in Forest County and the other five in Elk County. A very large number of rafting points was recorded, based on the research of Frank (1972; 1978). White pine/rafting urban historic districts consisting of high-style mansion architecture are present in Williamsport and Lock Haven. One additional property was identified as associated with this context, the Cook family mansion in Forest County.

*Lumber Heritage Region
Draft Historic Contexts*

Bark Peelers and Lumber Barons: Railroad Logging Arrives: 1864-1941

Thematic Statement: This context encompasses the period during which the logging railroad was the principal means of harvesting timber. The period begins with the commencement of the Philadelphia and Erie Railroad's Sunbury to Erie line and the earliest railroad logging operations dating to 1864 (Casler, 1973). Hemlock, in addition to white pine, was important in the dimension lumber market. Large tanneries and wood chemical plants operated in conjunction with sawmills during this period. The period ends with the nearly complete deforestation of the region and the resulting decline and collapse of its wood products industries.

Transportation Systems: Before and After the Railroad

The logging industry has always been an integral part of a growing nation. In the seventeenth and eighteenth centuries, the first European settlers generally only cut what they needed to clear land, build log cabins and furnishings, and provide firewood. Most of their needs could be met with simple equipment and a few oxen or horses. Some enterprising individuals established small water-powered sawmills and provided materials for local use, but transportation systems were primitive and early mills imported few materials and exported few finished products. In remote northcentral and northwestern Pennsylvania, pack horse trains were used to carry supplies until the late 1700s. Roads were not established between Bellefonte, Clearfield, Brookville, and Tionesta until the early 1800s and it wasn't until 1808 that a state system road extended between Wellsboro and Smethport, then west to Warren (Shank, 1988). The new road system allowed horse drawn wagons to import and export goods from the northern counties of Pennsylvania. The Susquehanna River was used for the commercial transportation and sale of logs beginning as early as 1796, but did not reach its peak use until forty or fifty years later. The 1830s brought the Pennsylvania Canal system to the northcentral counties of Pennsylvania. Although subject to seasonal limitations, the canal was a dependable means of transportation for lumber and people along the Susquehanna River and its tributaries, and was used until the late 1880s.

For many decades, river and canal transportation proved to be more efficient than overland transportation by wagon roads or turnpikes. This would all change with the arrival of the railroad. Developed in England, then introduced to the US at the end of 1820s, railroads were enthusiastically embraced as an efficient alternative to canals and turnpikes. In November, 1836, more than two hundred proponents of the new technology gathered in Williamsport and determined to establish a railroad from Erie to Sunbury (Groenendaal and Jones, 1998).

In 1864 the Pennsylvania Railroad [Philadelphia and Erie Railroad] was completed and opened for traffic. This line extended from Lake Erie eastward across northern Pennsylvania to Sunbury where it connected with other lines reaching the eastern seaboard. The line opened up an immense area of virtually uninhabited wilderness covered with dense forest. More important, the vast timber resources of northern Pennsylvania could be developed and shipped to far-distant markets (Casler, 1973).

Following the American Civil War of 1861-1865, railroads emerged as the dominant method of transportation in the US (Ross, n.d.). Networks of railroads such as the Baltimore and Ohio and the Pennsylvania Railroad met the demands of a growing and westward-expanding nation. The far-reaching effects included the creation of a truly national market economy (Ross, n.d.).

Property Types: Within the Lumber Heritage Region there are historic transportation features, including remnants of the Pennsylvania Canal system along the Susquehanna River, and common carrier railroads that are still used; as well as abandoned sections of common carrier railroad lines. Many original railroad stations still exist within the region.

Steam Power Technology

Originally developed in England in the late 1700s, inventors adapted steam engines for a variety of purposes, including water travel as well as railroads. Practical uses of steam power found their way to urban areas between 1800 and 1820. Essentially, “the steam engine [became] synonymous with the arrival of the industrial revolution at whichever point it was introduced” (Ross, n.d.).

For example, Ross (n.d.) describes the development of steam-power technology in the logging industry:

The transition from the water-powered sash and “muley” saws [was] not immediate, as might be expected from the widespread availability of steam power. Moreover, the circular saw, generally recognized as the technological successor to the reciprocating saw, was superior to the sash saw only in speed and productivity. Introduced in America in 1814, the circular saw made slow headway during the first half of the nineteenth century. The primary reason for this was the limitations of metallurgy during the antebellum era. Steel was scarce, difficult to manufacture and therefore expensive, and thus not often used for sawblades. Shaping a large sheet of iron into a flat, thin, and durable saw blade was, at best, difficult. This situation greatly limited the diameter of circular saws—which were then useless with large-diameter logs, which white pine tended to be.

It wasn't until after 1872 that circular saws and steam technology delivered significantly improved efficient production to the lumber industry (Ross, n.d.). But once established as an effective and dependable alternative to water power milling equipment, steam endured as a power source well into the mid-twentieth century.

Property Types: Within the Lumber Heritage Region there are several museums and historical societies that interpret and display steam-powered engines and steam railroad locomotive history. The Knox Kane Railroad operates a steam locomotive railway for tourists, but does not use any of the original locomotives in its Forest, Elk, and McKean County railroad.

Logging Railroads: The Early Years (1864-1886)

Things began to change after the Civil War. The rapidly expanding nation required more lumber and prices advanced. White pine was becoming scarcer, and the market gradually turned to hemlock and southern pine. The increasing demand for lumber made it imperative to cut other species formerly by-passed in favor of white pine. Hardwood was also coming into greater use. In order to keep mills running every day and also tap timber inaccessible to water, a better means of transporting logs was needed (Casler, 1977:1161).

By the early 1860s, common carrier railroads, were in the midst of a westward expansion to establish a transcontinental network (Pennsylvania Railroad, 1891). About this time, the first account of a Pennsylvania logging operation using a steam-powered rail line to haul logs came from rural Jefferson County. This first logging railroad, established by the Wright and Pier Company on Callen Run, was "4 miles in length, built of cribbing and stringers having wooden rails, all of which were bored and pinned to the stringers with wooden pins" (Kline, 1975:1266). The locomotive was built from a simple engine and a portable boiler that had been hauled all the way from Pittsburgh in early 1864. Pennsylvania's first logging locomotive was reported to be strange in appearance and could only push one car load of logs (Kline, 1975).

Unlike the common carrier railways which were meant to be permanent transportation systems, logging railroads were expedient operations that were designed with the short term goal of resource removal (i.e. logs, hemlock bark, and wood chemical material).

When a lumberman decided to build a logging railroad, numerous factors [were] taken into consideration...Among the factors were items such as length of track needed, the terrain to be traversed, volume of traffic, weight of load to be carried, and length of time [the track would] be used. Also the width or gauge of track, choice of material available, motive power, and rolling stock needed, maintenance of track and operating costs. The size of the mill and amount of lumber expected to be produced [had to] be compared with the investment required for a railroad before determining what kind of track to build. The cost of constructing the

railroad, and equipping it with the necessary motive power and rolling stock was the most important consideration. The investment must be in proportion to the amount of lumber to be produced and sold to make the venture profitable (Casler, 1977:1164).

Some of the more expedient railroads were built using pole tracks, best used on flat terrain. Wooden rail tramroads were also a less expensive option as were "stringers" or long partially-hewn logs with equally rough ties placed about 16 feet apart (Casler, 1977; Kline, 1975). The rails were placed directly on top of the stringers and spiked in place. The ties were used to ensure an equal spacing of the rails/stringers. Many of the early cars were actually drawn by teams of horses rather than using steam-powered engines (Kline, 1975). For a main line or a rail system intended to be used for a long time, steel rails on conventional cross ties were used (Casler, 1977; Kline, 1975).

Only two years after the construction of the Callen Run tramroad, and less than 7 miles down the Clarion River, the Frazier Railroad was established along Clear Creek in what is now Clear Creek State Park. W. H. Newcome also had a mile-long railroad or tramroad as early as 1866 along Big Mill Creek, south of the small town of Sigel, also in Jefferson County (Kline, 1975).

Another early logging railroad was established by the team of George and John Craig and Charles and Phillip Blanchard in Winterburn, Clearfield County. The first document that specifies the existence of the Craig and Blanchard [logging] railroad dates to April 11, 1874 (Kline, 1975:1227). John DuBois, for whom the city of DuBois is named, had a railroad or tramroad in his Clearfield County logging operations by 1882, and Joseph Lines built a narrow gauge tramroad at Sabula Lake in Clearfield County in the fall of 1883 (Kline, 1975).

In Clinton County, the team of Mensch and Lowenstein had a railroad logging operation near the town of Gleasonton. They operated a three or four mile narrow gauge railroad on Young Womans Creek between 1874 and 1878 (Taber, 1972b).

In Potter County, Frank H. Goodyear, who later became a partner in the Goodyear Lumber Company, established a sawmill and a logging tramroad at Wrights in Liberty Township sometime between 1875 and 1877. About 1880 or 1881, Goodyear also built a wooden tramroad on Sizer Run in Cameron County. The Wrights' tramroad may have only used horses, but there were documented accounts of a small steam-powered locomotive running on the Sizer Run tramroad (Taber, 1971).

One of the earliest railroads to serve a logging operation in Elk County was the Wilcox and Burning Well Railroad in Jones Township. This railroad, established in about 1881, was located along the West Branch of the Clarion River and it served the Wilcox Tannery and communities of Wilcox and Burning Well (Taber, 1974). The logging railroad on record as the second oldest in Elk County belonged to Henry M. and John B. Otto. In 1883, the Ottos built a railroad in Jones and Benzinger Townships on the North Fork of West Creek, a tributary to the

Sinnemahoning River (Taber 1974). Also in Elk County, William H. Hyde and Company established a standard gauge railroad in 1883 along Gallagher Run in Ridgway (Taber, 1974).

Wheeler and Dusenbury had one of the first logging railroads in Forest County. By the end of 1883, their line, known as the Reno Railroad, ran for 3½ miles along Hickory Run between their mill [located at or near the present town of East Hickory] and Otter Creek (Casler, 1977). Also located in Forest County, T.D. Collins had a tramroad on Little Coon Creek in Green Township in late 1882 or early 1883 (Casler, 1976).

Property Types: Some of the earliest railroad logging grades are still visible. Within Clear Creek State Park, the Frazier Railroad, which dates to 1866, is still apparent. In 1974, Thomas T. Taber III reported that Mike Bauer identified the remnants of the Albert and Frank E. Thompson tramroad, which dates to approximately 1886, on Island Run near Ridgway (Taber, 1974). Additional evidence of the early grades probably exists at other locations.

Northcentral and Northwestern Pennsylvania Common Carrier Railroads

By the early 1890s, Pennsylvania had a well-established system of common carrier railroads. Some of mainlines such as the Allegheny Valley Railroad and the Bald Eagle Valley Railroad were part of the Pennsylvania Railroad system. Others, such as the Ridgway and Clarion River Railroad, were part of the Philadelphia and Erie Railroad system. The Pittsburgh and Western Railroad, which was later acquired by the Baltimore and Ohio system, crossed the Allegheny Plateau from the southwest to northeast and connected communities such as Marienville, Pigeon, Russell City, and Kane. The system of lines which became the Buffalo and Susquehanna Railroad was established by lumber magnate Frank H. Goodyear beginning in the mid-1880s. The Buffalo and Susquehanna was initially intended to serve the Goodyear lumber industry, but was later used to carry coal and coke from other Goodyear family interests, and, under various ownerships, served local communities between DuBois and Buffalo, New York (Taber, 1971). The Williamsport and North Branch Railroad was a shortline common carrier railroad that served communities such as Hughesville and Picture Rocks in Lycoming County and Sonestown, Nordmont, and Laporte in Sullivan County (Taber, 1972).

In 1881, Walter Horton and Jerry Crary initiated the building of the common carrier railroad that they called the Tionesta Valley Railroad (TVRR). The TVRR ran between the town of Sheffield, in Warren County, and various points to the south including Brookston, Sheffield Junction, Pigeon, Byramtown, and later, Parrish, Loleta, and Hallton (Casler, 1973).

The Clarion River Railway was established in 1889 by prominent members of the Elk County lumber industry, including William H. Hyde, James K. P. Hall, and Andrew Kaul.

The [Clarion River Railway] cannot be classed as a logging railroad although it was intended and throughout its entire life it served only the needs generated by forest industries. It carried bark and finished lumber. Log trains of the Portland Lumber Company and the Elk Tanning Company operated over portions of it. In later years the output of the chemical company and hauling school children to and from school provided its livelihood (Taber, 1974:1034).

Andrew Kaul, the Hydes, and the Halls of Elk County also formed the St. Marys and Southwestern Railroad and the Buffalo and St. Marys Railroad, which were later combined to form the Buffalo, St. Marys and Southwestern Railroad (Taber, 1976). This railroad, formed during the 1890s, served to connect the town of St. Marys with the Western New York and Pennsylvania Railroad at Clermont in McKean County.

In January of 1900, T. D. Collins incorporated a shortline common carrier railroad to transport lumber and hemlock bark from the heart of Forest County to Sheffield and to connect with the Tionesta Valley Railroad in the east and the Pennsylvania Railroad to the west. Known as the Sheffield and Tionesta, Collins' railroad was a fine example of a well-planned shortline railroad that remained in use for many years, and, although Collins amassed a personal fortune from the operation, the Tionesta and Sheffield was also vital to other businessmen and the isolated communities along the Tionesta in Forest and Warren Counties (Casler, 1976).

Other significant railroad lines in the Lumber Heritage Region include the Warren and Franklin Railroad, which connected Warren and Oil City along the Allegheny River Valley, the Hickory Valley Railroad, which, beginning in 1886, connected the towns of East and West Hickory on either side of the Allegheny River in Forest County, the Bellefonte Railway in Centre County, the Johnsonburg and Clermont Railroad in McKean County, the Coudersport and Port Allegheny Railroad in Potter County, and the New York Railroad in Lycoming County.

Property Types: Most of the common carrier railroads were much more substantial than the logging railroads and were maintained for longer periods of time. Common carrier railroad tracks and stations are still present in many locations, and the abandoned grades of others can be identified as well.

Empire Builders: Pennsylvania's Lumber Barons of the Railroad Logging Era

During the height of the nineteenth century American Industrial Revolution, individuals such as John D. Rockefeller and Andrew Carnegie controlled entire industries such as petroleum and steel. Such men rose to prominence by different paths, but once established, these barons of industry manipulated the markets, the destiny of their employees, and the fate of their competitors. Similarly, a handful of very prosperous individuals and families came to control empires of land holdings, sawmills, tanneries, and transportation systems during Pennsylvania's

Railroad Logging Era. Because of their importance in the overall history of the Lumber Heritage Region, the most prominent of these men, families, and/or companies are discussed below.

John DuBois

Probably the most influential individual of the White Pine and Rafting Era, John DuBois continued to play an important role in Pennsylvania's lumbering history well into the 1880s. He was born in 1809 and raised in Oswego, New York along with nine siblings. When he was only 15 years old he entered the lumber industry, working in his father's lumber business and supervising the rafting of logs down the North Branch of the Susquehanna. Along with three brothers, DuBois moved to Pennsylvania where he bought and logged land north of Williamsport. Later, he moved to Williamsport where he continued in the lumber business, eventually rising to great wealth and notoriety as the president of the Susquehanna Boom Company in 1849. DuBois remained for many years in Williamsport, but at the age of 63, he moved west to Clearfield County, where he purchased land in 1870 or 1871. He began construction on his first Clearfield County sawmill in 1871, and by 1872 he was using a railroad or a tramway in his logging operations (Kline, 1975).

It was inevitable that the advantage of using a railroad to carry timber would occur to Mr. DuBois. Eventually, six logging-railroads would be constructed by DuBois or his contractors (Kline, 1975:1204).

DuBois was also in an excellent location to take advantage of both the Pennsylvania Railroad and the Philadelphia and Erie Railroad, guaranteeing that his new logging empire would have reliable transportation to both eastern and western markets (Kline, 1975). DuBois established another mill, known as the Big Mill, in 1874.

His mills predominantly cut white pine and, while no records remain of its density on DuBois' lands, it had to be intense to produce the lumber manufactured from the acreage involved. At any time in its history, the Big Mill ranked as one of the largest in the state, if not the largest, and only two sawmill plants in Pennsylvania may have bettered its ultimate daily production (Kline, 1975:1211).

DuBois later established a series of mills and industries including a box factory and planing mill, and a hemlock and hardwood mill, and then became partners in a tanning factory with the Van Tassel Brothers (Kline, 1975). Most of John DuBois' career predated the days of railroad logging, but he established a firm foundation for his successors. At the age of 77, the elder DuBois died and passed his entire operation to his nephew, John E. DuBois. "It was not evident at that time, but it was also a transition from water to railroad transportation" (Kline, 1975:1215).

Goodyear Brothers

One of the largest of Pennsylvania's Railroad Era logging empires was built by Frank and Charles Goodyear of Groton, New York. In the early 1870s, while still a teenager, Frank Goodyear obtained employment with a successful New York businessman who owned a sawmill, a grocery store and a feed and grain business in the western part of the state. During his employment, he gained valuable business experience, but perhaps more importantly, his marriage to his employer's daughter secured him a future in the lumber industry. In December, 1872, Frank Goodyear purchased his forest lands in Pennsylvania, beginning with land in Liberty Township in McKean County. By 1877, Frank's first sawmill, at Wrights in Liberty Township, was operating (Taber, 1971).

Late in the 1870s, Frank Goodyear ventured into Cameron County to expand his operations. He leased a sawmill along Sizer Run and subsequently purchased twelve hundred acres of forest land. He owned a rail logging operation at Wrights, but it is unlikely that he used steam-powered locomotives until opening the Sizer Run mill, which operated until 1883. Then he established another mill on Four Mile Run, also in Cameron County (Taber, 1971).

In 1884, Frank Goodyear considered purchasing a vast tract of land in Potter County. The land was formerly owned or controlled by William V. Keating, a wealthy land owner, and was located along Freeman Run (along which would eventually develop the communities and mills at Austin, Costello, and Wharton). Goodyear built a mill on Freeman Run in 1886, and the nearby town of Austin was established by 1888. To log and mill the isolated timber, Goodyear had to either float the logs to Williamsport or establish a substantial railroad (Taber, 1971). In spite of the expense, he chose to invest in a railroad, which marked his entry into the railroading industry. He contracted with mill owners to saw Goodyear logs, thus divesting him of the expense of maintaining sawmills (Taber, 1971).

Although the Goodyears were to build hundreds of miles of railroads in what eventually became the Buffalo and Susquehanna Railroad..., neither brother can be classified as railroad builders in the usual sense. Their railroad construction was intended to serve only as adjuncts to their primary interests. Initially this was lumber. Later coal and iron were added. Railroads were then built to haul these Goodyear products. That the railroads might also serve a few communities, other industries, and passengers was incidental to their real purpose of construction (Taber, 1971:505).

Seeking to protect his investments, Frank Goodyear attempted to control the price of lumber by establishing a trust. With the assistance of several other lumber industry operators, he helped establish the United Lumber Company. Economic conditions during the 1880s continued to be strong and Goodyear's attempts to suppress competition by fixing prices were not worth the effort. At age 38, he suffered a breakdown due to work-related stress, and in 1887, his older

brother, Charles W. Goodyear, stepped in to assist, resulting in the creation of the Goodyear Lumber Company (Taber, 1971).

During the 1890s, the Goodyear brothers continued to expand their railroad empire, and in 1893, portions of their railroad network became part of the Buffalo and Susquehanna Railroad (B&SRR). The Goodyears continued to build their empire into the twentieth century with the purchase of the Medix Run Lumber Company in Elk County, and the addition of coal mining and coke and iron operations. In the mid to late 1890s, the Goodyears extended the B&SRR into various branches and tributaries of Pine Creek in eastern Potter County and western Tioga County. This new line served the communities of Galeton, Walton, and Brookland in Potter County, and Watrous, Gaines, and Ansonia in Tioga County (Taber, 1971).

By the turn of the century, the growth of the Goodyear fortune began to slow down. With the majority of the remaining Pennsylvania timber owned by tanning companies, the Goodyears were faced with greatly diminishing supplies of hemlock. They responded by diversifying and entered the coal and iron industries in Pennsylvania, and the lumber industry in Louisiana. They also established a steamship line to bring Michigan iron ore to their processing plant in Buffalo and extended the B&SRR to Buffalo. Shipping coal to Buffalo via the Goodyears new railroad extension proved to be costly and the B&SRR could not compete with the more efficient Buffalo, Rochester, and Pittsburgh Railroad. With insufficient funds to operate the B&SRR, the Goodyears lost control of the railroad and it went into receivership in 1910 (Taber, 1971). Additionally, the Bayless Paper Company owned a pulp mill upstream of Austin, which was not related to the Goodyear mill. However, when the paper's company dam broke in 1911, the Goodyear mill and lumberyards were washed away. Because the timber resources were already running out, Goodyear did not rebuild his Austin mill after the flood (Taber, 1971).

The Kane Family

The Kane family figures prominently in the settlement and development of western McKean County. John Kane, the family patriarch and a lawyer and judge in Philadelphia, became an executor of the Samuel Leiper Tracts, a parcel of land totaling 132,000 acres in McKean, Elk, and Cameron counties. John Kane encouraged his son, Thomas L. Kane, to investigate the land and generate interest in coal production and the railroad industry. At the end of two years, Thomas L. Kane became an agent for the McKean and Elk Land Improvement Company. He is also recognized for organizing the Bucktail Regiment during the Civil War, and was made a general for his efforts. His connections with the company and payments owed to him helped him acquire approximately 95,000 acres in McKean County between 1874 and 1876, where he established a small town and a sawmill. The youngest of his four children, Elisha Kent Kane, would also pursue a career in the lumber industry (Taber, 1975).

Aside from his lumber and land businesses, Thomas L. Kane ventured into the coal industry and is credited with influencing the Pittsburgh and Western Railroad to extend their narrow gauge line to the town of Kane. He also "induced the Erie to build south, construction of which

included building the Kinzua viaduct" (Taber 1975:702). After Kane's death in 1883, his son Elisha K. Kane, took command of his father's interests and within three years had organized the Big Level and Kinzua Railroad, a railroad which connected the Pittsburgh and Western Railroad, in the southwest, with the Bradford, Bordell, and Kinzua Railroad in the northeast (Taber, 1975).

Since the majority of McKean County had only marginal coal deposits and his father's sawmill had burned, Elisha K. Kane turned his attention to the oil and gas industry. The Bradford Oil Boom of the mid-1870s had transformed the small logging town of Bradford, located 21 miles north of Kane, into an oil boom town. "By 1881, the Bradford [oil] field produced well over ninety percent of the national petroleum supply" (Ross, 1996:19). In early 1882, in response to decreased production of the Bradford wells, oil prices began to climb, which provided a window of investment opportunity before the volatile industry began to shut down in 1884 (Ross, 1996). The Kane oil field, located west of the town of Kane, was not tapped until 1885, but created the last big oil boom in northern Pennsylvania before production leveled off and the center of oil production shifted south and west to Ohio, West Virginia, and then to Texas (Ross, 1996).

With the decline in Pennsylvania's petroleum industry, Elisha K. Kane reentered the lumber business, and established a mill and a village on Kinzua Creek. He named the new community Kushequa, which, in the language of the Seneca Indians, means dark water. In 1889, he established the Mt. Jewett, Kinzua, and Riterville Railroad to connect Kushequa with the town of Mt. Jewett, located northeast of Kane. He is known for his small empire of logging railroads and shortline railroads that linked to larger common carrier railroads.

The railroad was always [Elisha K.] Kane's pride and joy. Its operation was taken very seriously by him. He considered it more than a logging railroad and with a definite permanent future (Taber, 1975:716).

Elisha K. Kane also established the Kinzua Hemlock Railroad, the Mead Run Railroad, and a branch of the Mead Run Railroad that followed Windfall Run, now located on the Allegheny National Forest. The Kinzua Hemlock and Mead Run railroads were built to access an estimated 12,000 acres of land located along Kinzua Creek and Mead Run that Kane purchased in 1889 and 1890 (Taber, 1975). Beyond the contribution of establishing connecting railroad lines between his own mill town at Kushequa, Elisha K. Kane's railroads benefited communities such as Smethport, McKean, and Farmers Valley to the east, and Mt. Jewett and Kane to the west. Not only did he provide employment at his mill and in his railroad logging operations, but he personally supplied relief for a number of unfortunate families that could not provide for themselves (Taber, 1975). Kushequa also supported other industries including a clothespin factory, a planing mill, two chemical plants, and Kane's own Kushequa Clay Brick Company (Taber, 1975).

In 1907, Elisha K. Kane recognized that there were trees left remaining, and he considered moving to a southern location to continue his logging operations. However, Kane chose to remain in Pennsylvania. A year later, trees remaining on Kane's land in Cole Creek, located

along his railroad between Farmers Valley and McKean, were suitable only for use in the manufacturing of wood chemical products. By 1910, Kushequa's sawmill had ceased to operate and only one wood chemical plant remained open. With the increasing availability of automobiles, the demand for passenger rail service declined. The Great Depression brought financial difficulties to Kane's railroad system, and in July, 1932, the majority of his failing railroads were dissolved. Kane died less than three years later (Taber, 1975).

Wheeler and Dusenbury

Except for a mill located at Newtown along Tionesta Creek, the Wheeler and Dusenbury empire was located on Hickory Creek, only a short distance from the Allegheny River (Casler, 1977). Compared to other Pennsylvania lumber "empires," the Wheeler and Dusenbury operation was relatively long lasting.

Originally from New York, the Wheeler family had been in the lumber business since 1795. While working a job along the Delaware River, William "Deacon" Wheeler met and began a friendship with the Dusenburys who were in the mercantile business. In the early 1830s, Wheeler and the Dusenburys formed a partnership to log 1,500 acres of land near Olean, New York, rafting lumber down the Allegheny to Pittsburgh, and Cincinnati, Ohio. They maintained a successful operation in the upper Allegheny River valley and became distinguished members of the town of Portville (Casler, 1977).

Deacon Wheeler's son, William F. Wheeler, became interested in timber resources located downstream in what is now Forest County. Circa 1837, the younger Wheeler used family money to buy 4000 acres along Tionesta Creek, and with the Dusenburys he purchased a mill at Newtown, in cooperation with a previous owner and a new partner, Hamilton Stowe. The Wheelers and Dusenburys continued to raft their lumber down the Allegheny, and invested their profits in land. In 1850, they opened a new mill along Hickory Creek. For the duration of their business venture, the Wheeler and Dusenbury center of operations remained in the vicinity of Hickory Creek and their new community, Stowtown (later named Rialto and finally, Endeavor) (Casler, 1977).

The Wheelers and Dusenburys were fortunate when the Warren and Franklin Railroad was established along the Allegheny River Valley in close proximity to their logging operations along Hickory Creek. However, the new railroad was located on the opposite side of the river from their mill, necessitating the use of log rafts in the spring, summer, and fall and transport across ice in the winter. After 1884, lumber was hauled across the river by horses using the first bridge to connect East and West Hickory. In 1886, the Hickory Valley Railroad (HVRR) connected Wheeler and Dusenbury's mill with West Hickory and brought lumber to the west side of the Allegheny (Casler, 1977). The HVRR also carried hemlock bark to the newly formed Hickory Tanning Company.

The Wheelers and Dusenburys succeeded in purchasing forest land at a low cost and selling most of their lumber for substantial profits (Casler, 1977). Unlike the Goodyears, the Wheelers and Dusenburys did not invest heavily in a railway system extending into another state, and they did not participate in business deals with which they were not familiar. They did, however, improve their sawmill equipment and upgrade their logging railroad to a standard gauge. Over fifty miles of grade and track were built on their land. Between 1900 and 1930 "any additional investment, excluding that for timber, would chiefly be used for logging railroad, locomotives, and equipment" (Casler, 1977:1113).

Despite extensive investments in forested land, the Wheelers and Dusenburys could not supply their mill indefinitely. In 1920, all remaining timber was sold to the wood chemical plant in Mayburg. Between 1930 and 1941, the Wheeler and Dusenburys' operations began to decline, and their hemlock mill was closed in 1928. The mills were dismantled and sold and unsaleable items were scrapped (Casler, 1977). By 1940, Wheeler and Dusenburys' empire in Forest and Warren Counties had come to an end. Although the mill was sold and replaced by a contemporary sawmill, the small town of Endeavor is extant.

T.D. Collins

Truman D. Collins, known as "Teddy" Collins, came to Forest County in 1854. At that time, many of the early pioneer era sawmills were still located on Tionesta Creek, and as logging operations progressively moved upstream, many loggers would raft squared timbers downstream to these mills during high water. In the mid-nineteenth century, an estimated 20,000,000 board feet of lumber was rafted down the Tionesta to the Allegheny annually. However, rafting on the Tionesta, a broad and shallow creek, was difficult. "Most of the great block of virgin forest awaited the coming of the big band mills and the logging railroads with their steam locomotives" (Casler, 1976:902).

Collins first operated a sawmill about which little is known, on Turkey Run in Forest County (Casler, 1976). After his Turkey Run mill, he ran a logging operation with a partner, but for a period of ten years beginning in 1876, he ran his own business. He moved to Nebraska in 1882 which became the "headquarters [of his logging business] for the rest of his life" (Casler, 1976:906).

Before his relocation, Collins purchased land in Green Township along Little Coon Creek and established a tram railroad. He used horses to pull the empty tram cars, and full cars were "wildcatted" down the grade with only a brakeman to make sure they did not derail (Casler, 1976). His horse-drawn railroad was known as the Fox Creek Tram, and it logged Little Coon Creek, Fox Creek, and Pine Hollow. In the ensuing years, Collins purchased more land and entered into partnership with Frank X. Kreitler of Jefferson County. At some point after 1886, Collins made improvements to his Nebraska sawmill and added a band saw, a "one hundred twenty five horsepower boiler and a larger power plant" (Casler, 1976:908). In 1887, Collins

replaced the horses on his Fox Creek Tram with a Shay Locomotive, the first of many locomotives he would own through the years (Casler, 1976).

In the late 1880s, Collins joined with Forest County native George Watson to form a long term partnership. With Watson taking over the management of the sawmills, Collins concentrated on increasing his logging empire (Casler, 1976). By the early 1900s, Collins had established major sawmills at Kelleetville, Bucks Mills, and Mayburg, and "he built and owned the Sheffield and Tionesta Railroad, a common carrier with forty one miles of main line, to handle the output of the mills" (Casler, 1976:916). He had also steadily acquired land, mills, and companies, such as the Lacy family's Golinza sawmill and the Salmon Creek Lumber Company's mill. His logging railroads included the Tionesta Valley and Hickory Railroad and the Tionesta Valley and Salmon Creek Railroad (Casler, 1976).

Collins died on April 15, 1914, leaving his empire to his only son, Everill.

During his lifetime [Teddy Collins] had amassed timber holdings which stretched across the heart of Forest County from Clarion County on the south to Warren County. He has established and operated nine sawmills, four of which were still running at the time of his death (Casler. 1976:922).

For a period of ten years after Collins' death, his land holdings continued to support sawmills. The railroads of the Collins' empire endured for nearly three more decades. "Of all the great lumbermen produced in Pennsylvania, [Collins] is today one of the best remembered, admired, and respected" (Casler, 1976:903).

Kaul, Hydes and Halls

Another notable lumber and railroad logging empire developed in Elk County during the late nineteenth century, was that of Andrew Kaul, and various members of the Hyde and Hall families. These early Elk County lumbermen and businessmen built a substantial logging empire across Elk County, but also profited from their connecting railroad lines and interests in tanneries and coal companies. Their partnerships with each other and various Elk County businessmen and lumbermen are complex. Taber summarizes them thusly: "Joseph S. Hyde was the starting point. The Halls married in; the Kaul worked in" (Taber, 1976:1015).

In the late 1830s, Joseph Hyde moved from Maine to settle in the Ridgway area. Through marriage, he became connected with the founding family of Ridgway, eventually purchasing his wife's family's sawmill and 400 acres. In the 1840s, Hyde established a department store and invested his profits in forest lands, building a foundation for subsequent generations to continue building a logging empire.

Joseph's son was William Hyde. Two of William's sisters married brothers from Centre County. The two brothers, John Hall and James Knox Polk Hall joined the Elk County logging

community. James Knox Polk Hall became partners with William Hyde. A third partner was Andrew Kaul. Kaul built his first sawmill in Jay Township and joined with J.K.P. Hall in 1871 to invest in out-of-state timber and purchase Pennsylvania hemlock. In 1876, they formed Hall, Kaul and Company (Taber, 1976).

J.K.P. Hall and Kaul continued to purchase substantial tracts of land, and between 1880 and 1886 they bought approximately 14,000 acres (Taber 1976). In 1882, Hall and Kaul formed a partnership with Joseph Hyde and established a sawmill in southern Elk County. Three years later they moved the mill to Croyland, near Laurel and Belmouth Runs in Horton Township. Hyde, Hall, and Kaul operated a mill at Portland Mills under the name Portland Lumber Company, the location of one of Joseph Hyde's first logging endeavors (Taber 1976). In the mid to late 1880s, Hyde, Hall, and Kaul established a narrow gauge railroad along Vineyard Run, also in Horton Township. In 1890, they built the Clarion River Railroad to connect the Pennsylvania Railroad at Croyland to the towns of Portland Mills and Hallton, along the Clarion River (Taber, 1976).

Meanwhile, during the late 1880s and early 1890s, Andrew Kaul and J.K.P. Hall continued to invest in land in Benzinger, Fox, and Jones Townships, and with their purchase of the "Cartwright properties" in central Elk County, their land holdings totaled an estimated 80,000 acres (Taber, 1976:1002). Between 1893 and 1895 Kaul, Hall, and Hyde formed two different railroads primarily to serve their interests in the coal industry. In 1897, the two rail lines were merged to form the Buffalo, St. Marys and Southwestern Railroad. During the same year, their St. Marys sawmill opened (Taber, 1976:1002). Although the St. Marys mill processed mostly hemlock, the Hall and Kaul land also provided other St. Marys' businessmen with the timber resources to sustain a stave mill, a kindling mill, and a wood chemical plant. Kaul and Hall incorporated their partnership in 1899, about the same time their railroad logging operation began to steadily clear the hemlock from Bear Run and Wolf Lick Run, located north and south of St. Marys, respectively (Taber, 1976). Kaul and Hall also cleared their lands in the Driftwood Branch, Windfall Run, and Crooked Creek valleys. In the early 1900s, they incorporated two more railroads, the St. Marys and Western Railroad and the St. Marys and Eastern Railroad, the latter paralleling the Pennsylvania Railroad along the north side of West Creek.

Andrew Kaul died in 1905, leaving his business interests to his son, Frank A. Kaul. The younger Kaul, an engineer, assumed responsibility for his father's unfinished work (Taber, 1976). As the new general manager of the Kaul and Hall Lumber Company, Frank Kaul "took a personal interest in all his employees, and it is said that he never had a foreman quit" (Taber, 1976:1002). Under Frank Kaul's management, Powers Run, Dents Run, Little Dents Run, Ten Acre Run, Trout Run, Sawdust Run, Pipeline Run, and Rock Lick Runs were logged (Taber, 1976). Due to a shortage of timber in the second decade of the twentieth century, and especially during World War I, the Kaul and Hall logging operations slowed considerably. By the fall of 1922, the St. Marys mill closed (Taber, 1976).

The Kauls and Halls brought business and employment opportunity to Elk County, and especially to the town of St. Marys.

The [Kaul and Hall] company is remembered today as having been a good place to work. One reason for this feeling was their attitude toward employees to have free lumber – he could take free all the lumber he could carry in his hands on his way home from work. Many an employee built his home one piece at a time, including one man who carried every stick one and half miles to his home site (Taber, 1976:1014).

Property Types: Some resources associated with the railroad logging empire families or companies such as mills, factories, railroads, and offices still exist within the region. For example, a former Buffalo and Susquehanna Railroad station, once part of the Goodyear empire, still exists in the town of Galeton, in Potter County. The Kinza Bridge viaduct is still a reminder of the Kane family's influence in McKean County. Many buildings in the town of Endeavor date to the historic railroad lumbering era established by Wheelers and Dusenburys.

The Height of Railroad Logging in Pennsylvania: 1888-1905

It is difficult to quantify the number of Pennsylvania logging, tannery, wood chemical, and other wood product industries that relied on logging railroads and small common carrier railroads, but the number is realistically in the hundreds, and probably higher. In fact, "Pennsylvania had a greater density of logging railroads than anywhere else in the world" (Ross 1997). From Cambria County to Tioga County, logging railroads extended into the interior of Pennsylvania's forests. During the height of Pennsylvania's railroad logging period (approximately 1888 to 1905), not only were the large companies using railroads, but so were the much smaller companies and family operations as well.

Although there were differences between logging operations, all companies had access to the resource (a tract or tracts of forest land) and a logging train to move the resource to a processing center (or centers), whether sawmill, tannery, wood chemical plant, or some combination thereof. Each company or operation also required a market and a mechanism (usually a common carrier railroad) to move processed goods to the market. A typical logging operation during the height of the railroad logging era still used teams of horses to skid logs to the railroad, but used steam powered locomotives to pull the cars. Some operations, such as T.D. Collins' at Little Coon Run in Forest County, still "wildcatted" the loaded cars long after acquiring steam powered locomotives. Most logging companies in operation at the height of the Railroad Logging Era also had steam-powered loaders such as the Barnhart. The design for the loader originated from a steam shovel devised by Henry M. Barnhart. Frank Goodyear urged Barnhart to modify the steam shovel to be used as a loader, and around 1887 Goodyear began to use the new loader in his operations (Taber, 1971). "The Barnhart loader was...a fast and efficient method for loading

logs” and it was “the first piece of labor saving machinery used in the woods” (Taber, 1971:520). Improvements in sawmill technology, such as the installation of band mills to replace circular saws, also typify operations during this period.

Examples of railroad logging operations that characterize the height of this era are listed for each county.

Cambria and Indiana Counties: The Vinton Lumber Company operated a railroad logging operation in both Cambria and Indiana County beginning in 1894 (Bartock, 2000). The company built a sawmill near Raxis, Indiana County, and established a 10-mile long common carrier railroad that terminated at present-day Stiles Crossing (Bartock, 2000).

Cameron: In 1881, the Barclay brothers and their father, built a sawmill in the town of Sinnemahoning. The brothers built their first logging railroad along Wykoff Run in 1888, while driving logs on another tributary to the Sinnemahoning. Toward the end of the century, the Barclays acquired more timber and increased the length of their railroad system, adding a line along Upper Jerry Run. Due to a shortage of logs about 1904, they began to run their mill intermittently, and by 1907, closed their operation (Taber, 1972).

Centre: In the early 1900s, the McNitt Brothers relocated from Mifflin County to establish stave mills near Hecla Furnace in Walker Township. Their first Centre County enterprise being unsuccessful, they joined a partnership with E. M. Huyett and in 1903 the operation moved north to Snydertown, also in Walker Township. There they established a sawmill and a logging tramroad. They operated their mill until running short of logs in 1909, when they moved to Waddle in Patton Township (Kline, 1971). Additionally, the Poe Mill’s operation, which operated from the late 1870s to 1899 in Penn and Haines Townships, was highly a productive mill in Centre County and resulted in a large camp surrounding the mill and a succession of mills and tramroads.

Clarion: Anthony Wayne Cook formed the A. Cook Sons Company and moved into the railroad logging industry with the purchase of land along Mill Creek in the early 1900s. He was granted permission to use a branch of the Pittsburgh, Summerville, and Clarion Railroad Company, which was built soon after. Cook established a 12-mile long logging railroad along Mill Creek and installed a new bandsaw in his mill (Kline, 1975).

Clearfield: The Wise Lumber Company had a railroad logging operation in Winterburn that ran between 1895 and 1905, after which they relocated to West Virginia to continue logging (Kline 1975).

Clinton: In 1889, William Howard and Allen Perley purchased land in Clinton County, upstream from Williamsport. Howard and Perley contracted with Oliver W. Wolf to log part of their land. Wolf established a 12-mile logging railroad along Young Woman’s Creek, which he soon sold to Howard, Perley, and their partner, Irving W. Gleason. Meanwhile, the operation

continued to float logs down to Williamsport. In 1891, however, Howard's Williamsport mill burned and he replaced it with a mill at Gleasonton. On April 23, 1893, the partners incorporated their logging railroad as the North Bend and Kettle Creek Railroad. A former employee of the operation, Albert Benshaw of Gleasonton, recalled that "there is a band saw, a circular saw, an edger, slasher and trimmer" (Taber, 1972:425).

Elk: In 1892, Thomas W. Raine built a sawmill in Spring Creek Township, Elk County. When he purchased land several miles away in Jefferson County, he decided to establish a logging railroad to connect with his Rainestown sawmill. His brother joined him in 1896 and their operation became Raine and Raine. Two years later, they replaced their circular saw with a band saw. Their timber supply ran out at the beginning of the twentieth century and they moved to West Virginia (Taber, 1974).

Forest: One of the larger lumber firms to operate in Forest County, the Levi S. Clough Company, had a railroad logging operation near Beaver Meadows, north of Marienville. Clough built a logging railroad in 1889 and named it the PT&E. His logging railroad connected McCray Siding, near the present-day Marienville Ranger Station, with his Salmon Creek mill, which ran until 1907 (Dyer, 1999).

Jefferson: In 1881, A.C. Hopkins purchased a mill in Reynoldsville in east-central Jefferson County. Hopkins upgraded the mill by adding two band saws and constructed at least 4 logging railroads on Mosquito Creek, Rathmel Run, Wolf Run, and Sherwood Run. His operation ran until about 1905 (Kline, 1975).

Lycoming: In 1881, J. B. Weed and Company purchased land in eastern Potter County in Stewardson Township. The company established a sawmill on Pine Creek and Slate Run in Brown Township, Lycoming County. In 1884, logs were still being splashed down Slate Run, but Weed and Company chose to establish a logging railroad, the first located east of Elk County. Between the mid-1880s and the first decade of the twentieth century, J.B. Weed and Company had a railroad logging operation in northwestern Lycoming County, as well as in southern Tioga and Potter Counties and eastern Clinton County. When the company's mill was replaced after it burned in 1893, it was fitted with a band saw combined with a gang saw. J.B. Weed and Company's mill was closed in the summer of 1910 (Taber, 1972).

McKean: Beginning in 1873, Spencer S. Bullis and his brother began logging in Pennsylvania. Bullis worked with his brother until 1887 and thereafter worked alone, acquiring additional forest land in McKean County. In particular, he purchased land in Foster and Corydon Townships. Soon after, Bullis entered the railroad business. "A railroad would be something new to him. Logs had been floated and sledged to his Carrollton and State Line sawmills. Now and for the next twenty years his primary interests were railroads and trolleys" (Taber, 1975:747). In 1886, he acquired the rights to the Bradford and Corydon Railroad and a year later, he incorporated the Allegheny and Kinzua Railroad, both of which later became the Allegheny and Kinzua Railroad. His railroads brought logs to his mills and other mills that were contracted to cut his logs. Bullis'

logging operation ran until 1897. He had financed his railroads with mortgage bonds, which led to his bankruptcy in 1898 (Taber, 1975).

Potter: The Lackawanna Lumber Company was established mostly by investors from Scranton, Pennsylvania, including Fenwick Peck and his father, J. Wilson Peck; William Connel; F.J. Megargle; William T. Smith; and J. H. Steele. The Lackawanna Lumber Company established a mill in Eulaia Township in the late 1880s. The company used a mill with a circular saw and ran a narrow gauge railroad up Town Run. This mill operated until it burned in 1894. The company purchased additional land in Keating and Roulette Townships in 1895. According to Orin R. Webb, a contemporary observer, the Lackawanna Lumber Company had two mills that serviced their new purchase. The Lackawanna Lumber Company then moved the center of their operations to the Cross Fork area in southeastern Potter County (Taber, 1972).

Tioga: In about 1901, Eben B. Campbell and Girard G. Hagenbuch purchased the rights to the timber on a tract of land in Asaph, located in Shippen Township. Campbell and Hagenbuch established a mill in Asaph, fitting it with a band saw and a resaw. They also established a two mile section of railroad to connect with the Buffalo and Susquehanna Railroad, and a tramroad on Asaph Run. The sawmill was reported to have produced an average of 60,000 board feet of timber a day in 1906. The mill was in operation until 1908 (Taber, 1972).

Warren: In the early 1900s, the Warren Lumber Company established a mill with a bandsaw, a box factory, and a standard gauge logging railroad along Grunder Run in Pleasant Township. The town of Grunderville grew up around the operation, which ran until 1906 (Casler, 1977).

Property Types: Resources such as logging railroad grades, logging railroad bridges, trestles or soil borrow pits, railroad junctions and sidings, train camps, and mills (including sawmills, barrel mills, lath mills, planing mills, shingle mills, turning mills, kindling mills, box mills, clothespin mills, and handle mills) are typical railroad logging operation properties. Also, features such as historic openings, mill ponds, dams, foundations, old sawdust piles, old log landings, evidence of wood chemical cuts (clear cuts), logging-related garbage dumps or artifact scatters, and single apple trees or orchards are considered to be Typical Railroad Logging Era property types. Within the Lumber Heritage Region, probably only a fraction of the resources have been identified and documented. During the preparation of this map, 29 documented logging railroad systems or lines were identified in both McKean and Elk Counties, 19 in both Warren and Forest Counties, three in Centre County, one in Jefferson County, four in Cambria County, 15 in Clinton County, and three in Clearfield County. Whereas few sawmills dating to the Railroad Logging Era have been formally documented in most of the counties, the US Forest Service has identified over a hundred on federal land within Warren, Forest, Elk, and McKean counties.

In addition to the companies that actually logged Pennsylvania's forests, others specialized in wholesale and retail lumber sales. These sales-oriented businesses were important, because they allowed the loggers to specialize in procurement and milling operations. Retail and wholesale lumber company property types include company stores, office buildings, and old lumber yards.

The Railroad Logging Era Woodsmen

The term "woodhick" was a name for the woodsman who did the majority of the manual labor in the cutting phase of the logging industry. The term "bark peeler" refers to the laborers who peeled hemlock bark for the tanning industry. "Jobbers" were men who were contracted to log and peel bark on specific tracts of land and who often employed woodhicks and barkpeelers to fulfill contracts. Larger operations required supervisors, called woods bosses, and specialized help such as cooks, teamsters, and blacksmiths. With the advent of the Railroad Logging Era, logging operations employed surveyors to establish railroad grades and trestles, and employed engineers, firemen, and brakemen to operate the railroads.

During the Railroad Logging Era, many of Pennsylvania's forests were logged by recent emigrants from Austria, Germany, Italy, England, and various Slavic countries. A cook from a camp on Trout Run in Lycoming County recalled that "some of [the men in camp] were from foreign countries, and were saving money to bring their family from Germany or Austria" (Taber, 1975:799-11). Old photos of William Howard and Allen Perley's sawmill at Gleasonton, in Clinton County, show that the mill "[employed] several Negroes, a rarity in Pennsylvania sawmills" (Taber, 1972:423). The lumber mills, tanning factories, and wood chemical factories also employed a great many immigrants. "The [Westline Chemical] plant normally employed about sixty persons of many nationalities: Italians, Slavic, Lithuanians, and Polish. Many came, worked a few years, and departed. Today, their descendants live throughout Elk and McKean Counties" (Taber, 1975:730). Often, the least preferable jobs were left for the new immigrants. "Work in the [tannery] leach house was hot, and most tanneries used foreigners for many of their operations. In early years Swedes and Danes were employed; by 1900 Slavic and Polish were often employed" (Taber, 1974:1088).

Many Italian men emigrated to work in Pennsylvania's lumber industry. The name "Italian Shanty Run" in Elk County is presumably derived from the men who once worked in the Bear Creek watershed. Leo J. Bailey, who spent part of his childhood in logging camps recalled his memories of an Italian crew near Four Mile Run in Tioga County.

The Italian section of men were building the woods railroad and their bosses were Mr. King and Tony, an Italian. They lived in a small camp that could be placed on a log car and moved when the work made it necessary. The section hands had a camp a mile or so down the stream from our camp. They did their own cooking, and it was interesting to watch them prepare individual dishes of spaghetti or macaroni (Taber, 1972:449).

Many Pennsylvania woodsmen also came from Scandinavia. Within the Lumber Heritage Region, the communities of Mt. Jewett in McKean County and Sheffield in Warren County had large Swedish populations.

A large number of the people who came to Sheffield and the surrounding area were of Scandinavian descent, mostly from Sweden. They made excellent woodsmen and expert tannery workers...In fact, many Swedes worked in the lumber camps from Pennsylvania to the Great Lakes and the Pacific Northwest. The Swedes were among the best woodsmen to ever fell a tree in America's great forests. Many of their descendants still reside [in the Sheffield] area (Casler, 1973:806).

The Camps

With few exceptions, the nineteenth century and early twentieth century logging operations did not practice sustainable forestry. Most of Pennsylvania's forests were intensively logged, leaving little behind but slash, cull trees, non-woody vegetation, and small seedlings. Given the nature of these cutting practices, the owners of logging operations and their employees were continually on the move. As a child, Clyde Lynch, whose father was a jobber for the Wellsboro Lumber Company, and later for the Central Pennsylvania Lumber Company, recalled his memories of relocating to a new lumber camp.

Each year we had to locate a new camp. I remember so well going with my father to find a new site. We had to find a spring which was located above the railroad track. The camp had to be between the two because the railroad brought in the bailed [sic] hay and food and other supplies (Taber, 1975:799-5).

The camps were rustic; each usually had a kitchen, a dining room, a bunkhouse, a blacksmith's shop, a horse barn, and some version of a pit toilet. Larger camps might have a company store or a company office. Lynch describes how isolated the camps were.

This camp was a self contained community with no contact with the outside world. The only contact we had was to get on horseback and ride out. The workers stayed in the camp weeks or months without getting out (Taber, 1975:799-6).

For most of the woodsmen, the element that distinguished a good camp (and a good logging operation) from a bad one was logging camp food. Most logging operation owners and contractors knew that to keep good men, it was important to feed them well. Word of both good camps and bad camps spread among the itinerant woodsmen, such that the camps with poor food and conditions would often lose men to camps with better kitchens and cooks.

Anna Eckert, who was a cook for a logging operation on Trout Run in Lycoming County, recalled some of the foods she prepared for the woodsmen.

[For breakfast] I had almost everything ready from the night before. The meat was cut, and the potatoes sliced. You had to cook the Mothers Oats oatmeal and the pancakes. There were big pitchers of coffee, but not tea. We had milk only for breakfast for the oat meal. The main thing we had at dinner was meat and potatoes and soup and gravy. You had pie and cookies on the table. Supper had meat and potatoes and fritters or johnny cake or something like that. The noon meal was the biggest meal (Taber, 1975-799-10).

Eckert also recalled how the food was served.

We dished everything up in big dishes and put it on the tables. Everyone put the food on their plate. There were no separate little dishes. If you had pudding, the men put it right on their dinner plate. You even put the soup in the same dish. They were deep dishes made of china. We had no metal cups or dishes; everything [was] china. If we had soup, they had it first before they put anything else on their plate (Taber, 1975:799-10).

Eckert also recalled that they used kerosene lamps for light and wood stoves for heat. The men at Eckert's camp used a barrel of water to wash in and hung their clothes on nails all over the bunkhouse. "They also washed their clothes on Sunday. They had a couple of tubs and a washboard" (Taber, 1975:799-11).

Property Types: Resources such as logging related garbage dumps or artifact scatters may actually constitute the remains of an upland logging camp. Approximately 200 such camps have been formally recorded on the Allegheny National Forest within the counties of Elk (58 sites), Forest (65 sites), McKean (27 sites) and Warren (44 sites). Additional surveys on federal land will likely yield more upland logging camps. Additional sites undoubtedly exist in other Lumber Heritage Region counties.

Pennsylvania Lumber Company Towns and Ghost Towns

Many of the towns established by the lumber industry during the height of Pennsylvania's Railroad Logging Era are today only a fraction of their former size and population. Many are simply tiny residential communities or clusters of recreational camps along old railroad lines. Some towns, like Ralston in Lycoming County and Endeavor in Forest County, still have an active lumber industry, although radically different from their historic logging operations. Other places, such as the town of Granere, located near Lantz's Corners in McKean County, are ghost towns with only a few railroad grades, stone foundations, and depressions remaining. Other towns, such as Straight and Instanter are also historic logging towns, but are now under the East Branch of the Clarion River Reservoir. The town of Penfield in Clearfield County, once had several sawmills and a tannery, but is now a small residential community at the crossroads of PA

Routes 255 and 153. Towns in Centre County, such as Port Matilda, Linden Hall, and Waddle had sawmills and historic railroad logging operations, of which little evidence remains. The many logging operations and logging railroads that once existed in Clinton County's small towns in Sugar Valley are no longer obvious. Urban historic districts that contain industrial and residential structures relating to one or more lumber companies, tanneries, and wood product industries are still evident in cities such as Ridgway and Williamsport.

Vestiges of company towns are often apparent only because a line of three or four identical, often small and narrow, houses still exists. There is a row of three houses along PA Route 321 in McKean County that probably housed employees who worked at the wood chemical company in Sergeant. Houses located along PA Route 948 in Brookston in Forest County are what remains of H.J. Brooks and Company's houses, offices, or stores. In the small town of Wilcox, the employee barracks is the last remaining tannery building. Usually, the residential components of an historic logging industry site are maintained the longest, and with few exceptions, buildings that once housed industrial operations such as tanneries or sawmills were the first to be scrapped and removed.

Property Types: Resources in this category include residential and industrial structures of a town that are related to the lumber, tannery, wood chemical, and wood products industries. Some of these may constitute historic districts. Also included in this class of resources are historic openings and archaeological sites where historic company towns once existed.

Wood Products Industries of the Railroad Logging Era

In 1912, the Pennsylvania Bureau of, in cooperation with the US Forest Service, issued a booklet entitled *Wood-Using Industries of Pennsylvania*. The book was designed to be a comprehensive list of industries that consume wood. Over the years, the Bureau of Forestry and the US Forest Service had received numerous inquiries regarding the market for various kinds of timber and lumber, and the report attempted to address these and other questions. Similar reports were also compiled for other states. The report identified and discussed almost every possible use for wood and it identified the best types of wood for each wood product (Simmons, 1914). Omitted from the survey was any kind of product that required little or no alteration after leaving the sawmills which included rough lumber, veneer, laths, shingles, crossties, cooperage, stock, posts, telegraph poles, chemical wood, and pulpwood.

Planing mill products, such as doors and sash, were listed in the report as the single largest use of Pennsylvania's wood for manufactured goods. They were followed by boxes and packing crates, and wood for the construction of cars, furniture, and chairs. Wood was also used to manufacture vehicles and vehicle parts (wagons), ships and boats, caskets and coffins, mine equipment, fixtures, boards for cloth and hosiery, patterns and flasks, handles, laundry appliances, cigar boxes, woodenware, tanks, silos, various machines, agricultural implements, and toys. To a

lesser degree, the following products were also manufactured from wood: trunks, brushes, shuttles, spools, bobbins, musical instruments, electrical machinery, pumps, baskets, frames, picture frames and other moulding, refrigerators, kitchen cabinets, playground equipment, printing material, ladders, elevators, whips, canes and umbrella sticks, plumbers woodwork, insulator pins and brackets, butchers' blocks and skewers, scales, professional and scientific instruments, pulleys and conveyors, boot and shoe findings, tobacco pipes, sport and athletic goods, saddles and harnesses, gates and fencing materials, clocks, rollers, and curtain poles. By 1912, Pennsylvania was actually importing more wood than it was producing, and many of these products were manufactured with materials from other states (Simmons, 1914).

Property Types: The wood products industry property types include any existing company or factory building that manufactured wood products during the railroad logging era. Probably very little remains of these industries, most of which probably burned or were torn down to build other buildings, for example the match factory in Bellefonte.

The Tanning Industry

"Tanning is one of the oldest industries in the United States, [becoming] one of the six big, widespread industries in Pennsylvania; the others being lumbering, coal mining, iron making, farming, and railroading. Tanneries were located in every county of Pennsylvania" (Taber, 1974:1082). Because of the plentiful availability of hemlock trees, which contained the natural chemicals used for tanning animal hides, Pennsylvania was an ideal location for the tanning industry.

In Pennsylvania, the tanning industry had three major stages of development: small, individually-owned tanneries, larger operators, and mergers. Individually-owned tanneries were located close to their bark supply and ample water. Many were miles from a railroad when originally built (Taber, 1974:1090). These tanneries operated predominately before the early 1870s, when larger ones began appearing (Taber, 1974).

The town of Sheffield, located in Warren County, developed as a center of the tanning industry in the mid-1860s. Sheffield was only a small stop along the newly-established Philadelphia & Erie Railroad when, Walter and Webb Horton and Horace and Jerry Crary established the Sheffield Tannery and formed Horton and Crary Company in 1867. Shortly thereafter, they opened other tanneries in Sheffield, Clarendon, and Brookston (located in Forest County). Horton and Crary continued to purchase timberland and foresaw an increase in the value of hemlock, as the availability of the more desirable white pine declined. They also recognized the value of the resources located on the Allegheny Plateau in Forest and Elk counties. In the early 1880s, they competed to establish a common carrier railroad to reach the vast stands of hemlock remaining on the plateau. The new railroad, named the Tionesta Valley Railroad, played a significant role in future tanning and lumber industry operations in northwestern Pennsylvania.

Although Walter Horton, the leader of the Horton and Crary tanning empire, died in 1891, what he established eventually culminated in the formation of the United States Leather Company (Casler, 1973).

In the early 1870s, the second stage of tannery development occurred. A rapid expansion in population created an increased demand for leather. Larger tanneries were constructed to meet this demand. "Railroads were built to them; otherwise the tannery could not compete" (Taber, 1974:1090). The larger tannery companies amassed substantial wealth and opened additional tanneries. By 1890, the tanneries had "reached their optimum/maximum size; and the only further development to make more money and increase power was by [merging with other companies]" (Taber, 1974:1090). "Within a period of a year, sixty-five tanneries, representing almost forty different companies, merged to form the United States Leather Company" (Taber, 1974:1090). Once formed, the United States Leather Company emerged as a formidable force in the business world, and by 1910, under the name of the Central Leather Company, was one of the ten largest companies in the US. The company consisted of three separate leather manufacturing companies: the Elk Tanning Company centered at Ridgway in Elk County, the Penn Tanning Company centered in Sheffield, and the Union Tanning Company centered at Westfield in Tioga County (Taber, 1974).

From procurement and processing of hemlock bark, to cleaning and scraping hides, and ultimately tanning, coloring and drying them, the tanning process was labor intensive and complex. Several tanneries established a laboratory in DuBois where chemists analyzed tanning chemicals and provided recommendations to improve the tanning process. After 1890, many tanneries had grown into large industrial complexes with buildings for engines, water pumps, storage of unprocessed bark, hide scraping and hair removal, leach storage, hide tanning, hide finishing and administrative offices (Taber, 1974).

After 1890, most of the state's standing hemlock was owned or controlled by tanneries and was destined to be used for tanning hides. The tanning companies had originally purchased land in efforts to create reserves of hemlock stands, and in the meantime had depended on hemlock bark provided by the lumber industry. Around the beginning of the twentieth century, the United States Leather Company had begun to cut hemlock on its own land, and Pennsylvania's hemlock trees began to go the way of the white pine before it. Even the tanneries were aware that the supply of hemlock bark was limited and began to search for substitutes for tanning hides.

Tanning was profitable until 1921 when it experienced about three bad years following the increased production during World War I. Picking up about 1925, the industry was again on its feet through the rest of the '20s then slipped again during the Big Depression. It was about 1938 when tanneries felt the inroads of substitutes [for leather] (Partridge, 1958).

Property Types: Resources relating to the tanning industry include any remaining factory buildings, offices, and any archaeological remains of such structures and surrounding yards where hemlock bark was stacked and dried. There is an active tannery at Westfield.

Corporate Mergers

By the 1890s, it became increasingly difficult for small railroad logging operators and other small wood products companies to compete with the lumber barons and railroad logging empires. Mid-sized and smaller companies, such as the Cartwright Lumber Company in Elk County, were less resilient and were often forced to sell their land holdings, mills, and railroads to pay debts. Competition in the lumber industry favored the formation of bigger companies, either by acquiring property from failing companies or by joining forces with other small companies.

One example of such a merger was the creation of the United States Leather Company, described above. The tanneries that became part of the United States Leather Company benefited through reduced competition and increased profits. The creation of the United States Leather Company also made possible the creation of the Central Pennsylvania Lumber Company, one of the largest lumber companies ever to operate in Pennsylvania (Taber, 1974).

J.B. Weed and Company, which operated the Slate Run Railroad in Potter and Clinton Counties in the 1880s, had long since proven that a tanning company could effectively operate its own railroad logging operation and sawmills (Taber, 1972). So when it became necessary for the United States Leather Company to cut hemlock on its own land to provide bark for its tanneries, several members of the board of directors proposed to establish a company to cut and mill the peeled logs rather than selling them (Casler, 1973). Thus, on April 29, 1903, the Central Pennsylvania Lumber Company (CPL) was born, and the United States Leather Company was soon producing lumber on a scale never previously attempted by a non-lumber industry entity (Taber, 1972).

Stretching across northern Pennsylvania in a belt fifty miles wide by 160 miles long, the Central Pennsylvania Lumber Company had more mills and cut more timber than any other lumber company in the state. There were sixteen mills at fourteen locations in seven counties. From its inception in 1903 until the final log was cut in 1941, it was to play a leading role in the lumber industry of the Commonwealth (Taber, 1972:490).

Shortly after the formation of CPL, the company set about acquiring existing sawmills to mill their logs (Casler, 1973). The initial headquarters of the CPL was in Ridgway, but within a month, the corporate office was moved to Williamsport in Lycoming County (Taber, 1972). The CPL soon purchased Amsler and Campell's Loleta mill in western Elk County, as well as mills at Grays Run and Williamsport in Lycoming County, Tiadaghton and Leetonia in Tioga County, Mina in Potter County, and Jamison City in Columbia County (Casler, 1973; Taber, 1972). The

CPL also developed plans to establish a mill at Sheffield, which was built and operating by 1908, (Casler, 1973). There was also a CPL mill at Trout Run in Lycoming County, about which little is known. As the CPL's operation grew from 1912 to 1917, it acquired additional mills in Masten in Lycoming County, Galeton in Potter County, and Laquin in Bradford County (Taber, 1972). Between 1917 and 1921, the CPL also built more new mills at Costello in Potter County and Kinzua in Warren County, and a new hardwood sawmill was added to Sheffield (Taber, 1972).

Much of the United States Leather Company's land was remote and required a substantial transportation system to harvest the hemlocks.

All the mills of the CPL were served by logging railroads. With these railroads of CPL, the Tionesta Valley Railroad, the Leetonia Railroad, and the Susquehanna and New York Railroad, the United States Leather Company had the most extensive network of logging railroads in the United States (Taber, 1972:492).

After the creation of the CPL, the three United States Leather Company divisions "the Elk, the Penn, and the Union Tanning Companies" handed over most of their land holdings (the majority of which were located on the east side of Forest and Warren counties, and on the west side of Elk and McKean counties to their new sister company (Taber, 1972). The majority of the CPL's holdings were in the more isolated and least populated areas, especially the Bear Creek and Big Run areas in Elk County. Now part of the Allegheny National Forest, the interior Allegheny Plateau region was less conducive to splash dam logging techniques, but turned out to be ideal for railroad logging. The Bear Creek tramroad, built in the early 1920s in the Big Run and Bear Creek watersheds, became the largest concentrated logging railroad operation to ever exist in Pennsylvania" (Casler, 1973:894). The years between 1925 and 1928 yielded the greatest cuts, which coincided with the famous Bear Creek fire that began on May 17, 1926. Thirty-five hundred acres of CPL lands were consumed by flames (Casler, 1973:899-5).

For most of the 1920s and into the 1930s, the CPL produced at least half of all of Pennsylvania's lumber. "In this dominant role they were able to control the lumber industry for the entire state" (Taber, 1972:492). However, by the late 1920s, only mills at Kinzua, Masten, and Sheffield remained open, and 1941, the last of CPL's lands were logged and the only remaining mill, located at Sheffield, sawed its final log on July 10, 1941 (Taber, 1972).

Property Types: The property types included in this category are historic resources (including structures, railroad grades and camps) related to large corporations such as the Central Pennsylvania Lumber Company.

The Wood Chemical Industry

Another industry that had close ties to the lumber industry was the wood chemical industry. Wood chemical plants produced wood-derived methanol, acetate of lime, charcoal, and acetic acid through various heating and distillation processes. The scavengers of the timber cutter, the wood chemical industry used small hardwood trees with a diameter as narrow as a few inches, most of which were worthless to the lumber industry and the majority of the other wood product industries. What remained in the forests after the hemlock bark and sawtimber were removed was generally considered ideal for the wood chemical industry. During the nineteenth century and for the first half of the twentieth, there were over seventy wood chemical factories operating in Pennsylvania (Taber, 1975). All of the factories were located within forty-five miles of the New York border, and that the greatest concentration existed in McKean and Elk counties (Taber, 1975). Taber speculates that the scarcity of oak, which yielded fewer valuable wood chemical products, combined with the availability of inexpensive natural gas, made McKean County the preferred location for a wood chemical factory (Taber, 1975).

Knotts (1995) provides a concise description of the wood chemical industry products:

Charcoal was used heavily in early blast furnaces for production of iron. It was also used in the manufacture of black powder, as an ingredient in stock and poultry food, in case hardening compounds, and as a deodorizer. The acetic acid was heavily used in the chemical industry and in the preparation of white lead pigment. It was also used to prepare cellulose acetate for films, lacquers, plastics, and artificial silk. It was used in the preparation of numerous solvents and in the processes of textile plants, laundries, tanneries, insecticides, soaps, and many other industries. The wood alcohol was used in the manufacture of varnishes and lacquers, formaldehyde, and synthetic resins such as Bakelite. Wood tar was used in preservatives, pitch, and creosote .

Some owners of wood chemical companies, like Nicholas W. Heinemann, a resident of eastern McKean County, also operated sawmills and had railroad logging operations (Taber, 1975). Conversely, after becoming a millionaire in the lumber and railroad industries, T.D. Collins ventured into the wood chemical business with the establishment of the Mayburg Chemical Company in Forest County (Casler, 1976). Thomas Keelor, who operated sawmills at Wetmore and along the East Branch of the Tionesta, also operated the Keelor Chemical Company. Keelor's railroad was used to haul logs to his sawmill and later to haul the remaining small hardwoods from Rock and Thomas Runs to his chemical factory (Taber, 1975).

The products produced by the wood chemical industry were subject to unpredictable demands, including the use of charcoal in gas masks during World War I. During Prohibition, methanol was in high demand by companies that produced alcohol from molasses. Such a grain-based alcohol product was still drinkable, and the companies were required to render their product unfit for human consumption. Theoretically, they accomplished this by mixing it with the methanol,

which they did not always do. Apparently, simply keeping receipts for their purchase of methanol satisfied the authorities (Taber, 1975).

Improved techniques for distilling wood and processing charcoal were developed, increasing output. Unfortunately, other methods of making products such as acetic acid and methanol were developed, which resulted in reduced profits for the industry. Trade associations such as the National Wood Chemical Manufacturers Association attempted to control prices, but also instead created chaos. In the wood chemical industry version of a corporate merger, the Susquehanna Chemical Company was formed in 1946 to create a conglomerated wood chemical company from many independently owned companies (Taber, 1975). The intention was to form a company that would be as strong as the United States Leather Company had been, but poor organization and economic misfortune resulted in bankruptcy in just over two years (Taber, 1975). In decline since the 1930s, Pennsylvania's wood chemical industry was near the end by the outbreak of World War II.

With reduced needs caused by competing processes and the Depression, the wood chemical industry fared badly. In Pennsylvania the last large plant, the Mayburg operation, closed in 1942 when the Sheffield and Tionesta Railroad, which served it, was torn up and the rails were used elsewhere for the war effort. Smaller plants continued thru [sic] the war and into the early 1950s before giving up (Taber, 1975:760).

Property Types: Resources related to the wood chemical industry include any remaining industrial structures, historic openings where wood chemical factories once existed and any remaining ruins or archaeological features associated with such structures. Related property types include landscapes with evidence of wood chemical logging practices and thick deposits of tar-like waste left behind by wood chemical company operations.

The Paper Industry

Before the American Industrial Revolution, paper products were manufactured from a variety of different materials, including various fibers, textile waste, and rags. Pre-nineteenth century paper was manufactured using primitive machines, wire molds, and cylinders for rolling and flattening the paper. But by the early 1800s, the paper industry was beginning to improve mechanized processes to produce paper. The invention of groundwood pulp in 1843 and the introduction of the chemical pulp process in the mid-1800s substantially improved the efficiency and productivity of American paper mills (CEPI, n.d.).

In the earliest times of the industry, paper mills located in urban areas had the advantage of an available workforce and were appropriately located in cities such as Philadelphia and Pittsburgh. However, with the introduction of groundwood pulp technology, it became practical for paper mills to locate closer to large sources of wood. In the last two decades of the nineteenth century,

tanneries and sawmills discarded wood that could be used to make paper. Beginning in April, 1880, the Philadelphia-based paper manufacturers, Armstrong and Company, took advantage of the wood resource in Clinton County and established the Pennsylvania Pulp and Paper Company at Lock Haven. Eight years later, the Armstrong family established a mill in Elk County along the Clarion River in Johnsonburg. This mill, known as the Clarion Pulp and Paper Company or the "Clarion Mills," would become the largest paper manufacturer in western Pennsylvania (McLaughlin, n.d.). In 1890, the Armstrong paper mill companies merged with the Champlain Pulp Company of upstate New York and became the New York and Pennsylvania Company. In 1919 or 1920, under the parent name of the New York and Pennsylvania Company, the Castanea Paper Company was formed and a mill was established near Lock Haven (McLaughlin n.d.). This mill was later acquired by the Curtis Publishing Company which, by the 1950s, had acquired the New York and Pennsylvania Company (Wessman, 1981). The Lock Haven paper mill was owned and operated by the Hammermill Paper Company before its purchase by International Paper. Today, Willamette Industries owns and operates the Johnsonburg paper mill.

One paper company is connected to the tragic destruction of the town of Austin, located in Potter County. In 1910, the Bayless Paper Company built a dam to provide water for its paper mill. On September 30, 1911 the dam broke, destroying much of the town and killing seventy-nine people. The paper mill continued to operate until 1942, and the dam ruins and remnants of the paper mill are extant (Currin, 2000).

After World War II, while Pennsylvania's lumber industry showed little increase in production and sales, Pennsylvania's pulp and paper industry experienced a steady rise in demand (Saylor, 1959). Though there are few manufacturers of paper located within the proposed Lumber Heritage Region, relative to other wood product industries, they produce a specialty product that is in high demand and less subject to a volatile market.

Property Types: Property types associated with the paper industry include historic paper mills that are still operating (such as the Willamette Industries Mill at Johnsonburg in Elk County), and mills that are no longer operating, but of which there is still evidence (such as the Bayless paper mill at Austin in Potter County).

Lumber Industry's Relationship to Other Major Pennsylvania Industries (1880-1930)

The success of the lumber industry was partly based on its interrelationship with other nineteenth century industries. Specifically, the greater lumber and wood products industry (including the paper, wood chemical, and tanning industries) had important ties to the petroleum, coal, and steel industries, but also had important connections with non-extractive industries such as the railroads and agriculture. Each of these industries supplied the lumber industry with important resources or provided a substantial source of capital.

Petroleum

The development of the petroleum industry in the Allegheny Plateau region also had effects on the lumber industry.

The discovery of plentiful supplies of crude oil in Venango County throughout the 1860s, Warren and McKean counties in the 1870s, and Forest County in the early 1880s created a significant local demand for timber. Coopers required oak staves in huge quantities, and rigbuilders used large quantities of pine, and later hemlock, for building rigs and derricks. The boom towns that mushroomed at the fringe of each new strike also created a market for dimension stock (Ross, n.d.).

Intersecting interests between the lumber and the petroleum industries is exemplified by the oil boom railroads in the early 1880s. In response to "oil fever" in the Farnsworth Valley west of Sheffield, a railroad was constructed with the backing of local bankers and businessmen. Within a period of three months, the Warren and Farnsworth Valley Railroad was transporting over 20,000 barrels of oil a day. In response to the demand to transport oil and passengers to and from Garfield, an oil boom town, the Garfield and Cherry Grove Railroad was built and began operating within one month. The oil boom declined after only six months and the boom town of Garfield contracted to a few shops and a fraction of its former population. Though the post-oil boom profit-margin was slim to non-existent, the Warren and Farnsworth Valley Railroad was used by several lumber mills and Horton and Crary's tannery and operated until 1895 (Taber, 1975).

Another rail line that was built with interests common to the petroleum and lumber industry was the Kane Oil Fields Railroad. In 1886, the James brothers established a railroad in McKean County between East Kane and Jo-Jo, a town named for Joseph Cappeau and Joe Craig who made their fortunes in the Kane Oil Fields (Ross, 1996).

The wood chemical plants located in McKean County also benefited from the availability of low-cost natural gas (Taber, 1975). With an abundance of a cheap fuel, the greatest number of Pennsylvania's wood chemical plants were in McKean County (Taber, 1975). In fact, one entrepreneur, Thomas Keelor from Cincinnati, Ohio, became a successful lumbermill and wood chemical plant operator, even though he had originally intended to make his fortune in the petroleum and natural gas industry (Taber, 1975). For many years, Keelor operated a logging railroad in McKean County between Wetmore and the East Branch of the Tionesta, before he finally established and profited from a gas well on his Tionesta Valley property (Taber, 1975).

Coal Mining

The underground mining industries of eastern and southwestern Pennsylvania were dependent upon the lumber industry to supply a wide variety of wood products, especially the large "prop" timbers used in supporting subterranean mining shafts. Wood was also used for mine cars,

railroad ties, and buildings in the company towns. Private landowners and farmers supplemented their income by providing the coal mining industry with prop timber. Logging railroads also supplied prop timber. One of the most prominent families to do so was the Kulp family, whose operations were located in Mifflin and Centre counties. The McNitt-Huyett Lumber Company, located in Waddle in Centre County, also produced substantial amounts of prop timber (Kline, 1971).

Aside from the mine props, large amounts of wood were used within the deep interior of underground mines. Various types of wood products were used in the ventilation systems, doors, "manways," and "pit railings." Several different species of hardwoods were used for rollers and other parts of "haulage systems." Perhaps one of the more unusual uses of wood was for "sprags." A sprag was a 21" long, 2 1/4" to 3 1/4" diameter piece of wood used to regulate the speed of the coal and ore carts. Miners inserted the sprags between the spokes of the wheels, causing one of the wheels to lock, thus slowing or stopping the carts (Simmons, 1914).

Iron and Steel

Scattered throughout Pennsylvania are the remains of iron furnaces that were built from substantial cut stone blocks. Early furnaces, such as Clarion County's Licking Furnace, Clearfield County's Karthus Furnace, Cambria County's Eliza Furnace, and the 16 furnaces of Centre County, were fired with charcoal (Sharp and Thomas, 1965). The smaller blast furnaces of the mid-nineteenth century used supplies of charcoal that were manufactured from local sources of timber. Furnaces were also fired with anthracite coal in eastern Pennsylvania and, to some degree, bituminous coal was used in southwestern Pennsylvania. After the 1850s, many of the western Pennsylvania blast furnaces, especially Pittsburgh's furnaces, were fired with coke, a less volatile carboniferous fuel produced from bituminous coal. The use of coke to fire furnaces decreased the steel industry's dependency on Pennsylvania's wood resources. None of Centre County's sixteen furnaces used coke, but all the surviving furnaces except Curtin Furnace converted to soft coal after 1860 and continued firing furnaces with soft coal until the last furnace was permanently shut down in 1920 (Kelley, 2000; McNeal 2000).

With the advent of the "Age of Steel" in the mid-1870s, Pittsburgh became the dominant force in the metal industry with its new, more durable, versatile, and mass-produced steel (Steel Industry Heritage Corporation, n.d.). Although the lumber industry and communities of the upper Allegheny River supplied Pittsburgh's need for lumber, the lumber industry in turn benefited from improved steel technology. Without mass-produced low cost steel, the huge band saw mills, and indeed the logging railroads, could not have been built.

Glue Factories and Mattress Manufacturers

Industrial interrelationships are sometimes obscure. For example, the hide tanning industry removed hair, flesh, and remaining appendages of hides, all of which were used by other industries. The hair was used by mattress manufacturers, and fleshy parts of the animal were

used by glue factories. The tanning process required chicken manure, lime, pigments, fish oil, and epsom salts (Taber 1974), providing financial benefits to the suppliers of such materials.

Resource Depletion and the Decline of Pennsylvania's Railroad Logging Industry

Between the intensive and extensive logging operations and frequent wildfires, Pennsylvania's forests yielded less sawtimber and hemlock bark as the twentieth century wore on. What little remained by the end of the Great Depression was of a marginal grade, was not economical to cut, or was only useful to the wood chemical industry, though that industry was declining also. In the prologue of his book *Tionesta Valley*, Casler foreshadowed the fate of Pennsylvania's forests during the railroad logging era:

The stately hemlocks bowed their heads sadly, because the great forest was soon to hear the ring of the woodsman's axe. The denizens of the wild were soon to waft the nauseous odors of tanning hides. The beautiful hemlocks would be felled and the forest reduced to a wasteland. Huge brush piles, often consumed by fires, would dot the landscape, leaving a dismal expanse of desolation (Casler, 1973:801).

With very little virgin forest left standing, the few lumber companies and sawmills still operating in the late 1930s, such as the CPL's Sheffield mill and Wheeler and Dusenbury's Endeavor mill, were on the brink of bankruptcy. Closed mills were sometimes sold, but were often left dormant, scrapped, or burned. The focus of North American logging had shifted westward, first to the Great Lakes region, and then to the Pacific Northwest. Some Pennsylvania lumbermen, such as the Goodyears and J.J. Newman from Potter County, had established successful logging operations in the south (Taber, 1972, 1971). By 1942, the last of Pennsylvania's large sawmills had closed and the era of railroad logging had ended.

*Lumber Heritage Region
Draft Historic Contexts*

Forest Conservation and the Recovery of a Resource, 1895-1945

Thematic Statement: The Forest Conservation and Protection Era is characterized by the efforts of state and federal agencies to control the many problems associated with the deforestation that occurred in Pennsylvania over the previous century, including serious wildfires, soil loss, and the rapidly declining availability of forest resources. During the Depression, President Franklin Delano Roosevelt promoted the policy of “Recovery, Relief, and Reform”, which, for the forests of Pennsylvania, meant reforestation and conservation. The Civilian Conservation Corps had one of the largest roles in rebuilding and repairing the state’s forests during the Depression. This period ends with the substantial recovery of the forest and the economic upswing in the United States at the end of World War II.

Not a Limitless Resource

The industrial era logging operations efficiently and systematically cleared the majority of northcentral and northwestern Pennsylvania’s forests, leaving the landscape scarred, almost treeless, and vulnerable to wildfires. By the turn of the century, only the more remote and difficult to access forest lands remained uncut. Limited portions of the cut-over and cleared land were suitable for agriculture, but the vast majority of the land had little commercial value after it was logged. The competition for the remaining forest resources grew more intense as people realized that there was not an endless supply. This was a concern for not only the lumber companies, but for public officials and private citizens, who were interested in non-commercial forest values. The period between 1895 and 1945 is characterized by the efforts of private citizens, and the state and federal governments to conserve forest resources and reverse the negative effects of the intensive and extensive nineteenth century logging practices.

The Birth of the Conservation Movement

The forests that Pennsylvania’s pioneers encountered in the seventeenth and eighteenth centuries have often been romanticized as virgin stands of timber. Today, it is widely known that the northeastern woodlands had been, in effect, managed by the Native Americans since the Pleistocene Era. The eastern climax forest that the early settlers encountered was created by the

deliberate and accidental application of fire by the Native Americans. The clearing of land by Euroamerican settlers for farmland was initially similar to the Native Americans use of land for agriculture and hunting. As the Native Americans were pushed further west and north across Pennsylvania in the seventeenth and eighteenth centuries, forests no longer received regular fire treatments and the potential for catastrophic wildfires began to increase (Pyne, 1982).

As early as the 1700s, laws were passed to control wildfires associated with clearing land and obtaining wood resources, but it was not until the late 1800s that wildfire prevention laws carried any severe penalties. Aside from these acts of legislation, the vast clearing and consumption of Pennsylvania's forest lands generated little concern for the environment from either private citizens or public figures. Additionally, the importance of agriculture during the eighteenth and nineteenth centuries perpetuated the belief that cleared land was more valuable than forested land.

However, it became increasingly difficult to ignore the complete and vast deforestation that was occurring. On the Allegheny Plateau, where most of the timber was cut between 1890 and 1930, forest fires became particularly common in areas where coniferous trees had existed. The substantial quantity of coniferous logging slash furnished perfect conditions for catastrophic wildfires (Marquis, 1975). Beginning in 1873, Governor John F. Hartranft promoted legislation to prevent the "stripping of our mountains and hills for their trees" (DeCoster, 1995:3). In the mid to late nineteenth century, private citizens and scientists interested in the conservation or preservation of forests began to form groups like the Pennsylvania Forestry Association to further their cause.

During the mid-1880s, interest in the forest preservation movement grew among concerned citizens in the Philadelphia area. Discussion sessions pertaining to forest destruction hosted by a Philadelphia women's group included the participation of Joseph T. Rothrock, a prominent botanist who had given speeches on aspects of forestry at the Michaux Forestry Lectures as early as 1877 (DeCoster, 1995). After Rothrock's nomination as president of the Promotion of Scientific Forestry (later known as the Pennsylvania Forestry Association), he became a tireless spokesperson for Pennsylvania's forests for the next three decades. Rothrock's importance in the history of Pennsylvania's management and conservation of forest resources cannot be overstated. In 1895, legislation was passed that allocated funds to evaluate the state of Pennsylvania's forests and provide recommendations concerning forest resources. Rothrock was one of two individuals assigned to inspect the forests and provide a report to the governor. This report, fueled by Rothrock's dedication and the support of concerned citizens, culminated in the establishment of the Division of Forestry in Pennsylvania's Department of Agriculture in 1895. Rothrock then became the state's first Forest Commissioner (DeCoster, 1995). An act of legislation in 1897 created the Pennsylvania Forestry Reserves which subsequently allowed the

state to purchase land to create state forests.

Technology at the Turn of the Century: The Automobile Brings Mobility and Flexibility to Americans

During the nineteenth century, America's economy depended heavily upon the railroad, but during the twentieth century, the automobile became the force that brought great change to America's culture and economy (Cantelon and Durr, 1996). The automobile promised more flexibility to the individual than the railroad, and greatly influenced the pattern of tourism and recreation, as well as the procurement and distribution of commodities like logs, lumber, and finished wood products.

Although a steam-powered car was built as early as 1863, the practicality of the first American automobiles was limited by poor roads and cities separated by great distances. The first automobiles were produced carefully, slowly, and at great cost to the purchaser. At first only the wealthy owned automobiles; but after 1905, in an effort to sustain interest and sales in new automobiles, the auto industry developed moderately-priced models to sell to the middle class (Flink, 1975). By the end of the first decade of the twentieth century, the automobile was indispensable and companies such as Ford, Buick, Cadillac, Oldsmobile, and General Motors had become household names.

On April 6, 1917, the United States entered World War I. The American auto industry responded by producing enough automobiles and trucks to move troops and supplies during the war effort (Flink, 1975). This ability to move large quantities of resources in an efficient and inexpensive manner proved the value of using trucks for hauling supplies, including logs and lumber, for non-military purposes.

During the first decade of the 1900s, the wealthy used automobiles for recreation and the middle and working classes primarily for more functional purposes. By the 1920s, however, all but the poorest Americans could afford an annual automotive vacation to national forests, parks, and historic sites (Flink, 1975).

Theodore Roosevelt's Conservation Legacy

Forest Reserves, later renamed National Forests, were first set aside in 1891 during President Benjamin Harrison's term of office. The Forest Reserve Act did little more than "reserve" the

forested lands of the west and prevent settlement. At the time the act was passed, no provisions were made to manage the land, even though the act was designed to protect the trees from exploitative tree harvesting. It wasn't until Theodore Roosevelt became president that provisions were made to actively conserve and manage resources on the Forest Reserves.

In the early 1880s, Theodore Roosevelt served in the New York State Assembly, but after his wife and mother died tragically, he retreated to the Dakotas and spent two years as a cattle rancher, where he developed a fondness for wildlife and nature. He returned to politics and, beginning in March, 1901, served as President William McKinley's Vice President. Following McKinley's assassination in September of the same year, Roosevelt, at age 42, became the youngest man to serve as President of the United States. Known as a champion of conservation, President Roosevelt facilitated the designation of five National Parks, 51 federal bird reservations, the first four national game preserves, the first 21 reclamation projects, and the first 18 National Monuments (Gable, 1992). From the Forest Reserves, he established 150 National Forests, which were administered by the Forest Service beginning on February 1, 1905.

State Game Lands

Coinciding with the late nineteenth century public interest in forest conservation, was the growing interest in Pennsylvania's wildlife and game populations. As settlers filtered into rural areas of northcentral and northwestern Pennsylvania during the first half of the 1800s, they caused fragmentation of forest habitat, restricting the movement and protection of wildlife. Deer herds were particularly vulnerable to the added hunting pressure and by the century's end, deer had become so scarce that they were no longer hunted (Kosack, 1995). In 1896, a Board of Game Commissioners (later renamed the Pennsylvania Game Commission) was established to address issues and concerns relevant to wildlife and game populations. The establishment of game preserves proved to be an important step in establishing a protected habitat for Pennsylvania's deer herds. Pennsylvania's first game reserve was established in Clinton County and was located on private land 12 miles south of Renovo. For a 19-year period beginning in 1906, Pennsylvania imported deer from Michigan, Kentucky, Maine, New Hampshire, Ohio, and other states in efforts to rebuild Pennsylvania's deer population (Kosack, 1995). With efforts of the Pennsylvania Game Commission (PGC), additional hunting restrictions, and the establishment of game reserves, Pennsylvania's deer populations recovered.

The game reserves had greatly improved the PGC's ability to manage the deer herds, but because all game reserves were located on private land, they had limited ability to influence the protection or improvement of deer and wildlife habitat. Finally, in 1919, Governor William C.

Sproul authorized the purchase of land “for game preserve purchases” and the PGC became a land management agency as well as an enforcer of hunting restrictions (Kosack, 1995:54). The first of the state game lands, SGL 25, is located in Elk County. Following the purchase of SGL 25, the PGC launched into a flurry of land purchases, and by 1930 there were more than 175,000 acres of state game lands (Kosack, 1995). Hunters readily accepted the concept of game lands and became more willing to adhere to game laws. Except for the depression years, when money and food were in short supply, hunting soon became more of a sport than a primary means of feeding one’s family.

A rebirth of interest in cut-over and neglected game lands spawned an onslaught of tree planting during the 1920s (Kosack, 1995). In particular, game lands were planted with a vast diversity of trees and shrubs that provided substantial food resources for deer and a variety of game and song birds. During the Great Depression, the state game lands benefited from the CCC. Workers from both organizations contributed a substantial amount of work, including the establishment of roads, fire trails, and tree and shrub plantations. By World War II, stands of trees on game lands had matured into merchantable timber and were harvested for the war effort. During this period, the PGC reported that wildlife habitat on state game lands had “materially improved” (Kosack, 1995). In the late 1940s, the PGC inaugurated research programs that focused on whitetail deer, including analysis of population carrying capacities and effects of populations on timber and crops (Kosack, 1995).

The National Conservation Movement

If Joseph T. Rothrock is recognized as Pennsylvania’s Father of Forestry, the person who stands out as America’s Father of Forestry is Gifford Pinchot, the first American-born man to obtain a forestry degree. Pinchot was born in Simsbury, Connecticut to upper class immigrant parents. He attended Yale University and then decided upon a career of forestry. After obtaining a forestry degree in France, Gifford Pinchot returned to the US where, through personal connections with Theodore Roosevelt, he obtained an appointment at the US Department of Interior in 1897 as a “special forest agent” (Klein and Hoogenboom, 1980). By 1898, he became director for the Department of Agriculture’s Division of Forestry. Gifford Pinchot helped President Theodore Roosevelt establish the US Forest Service, an agency that still remains in the Department of Agriculture, largely because it was founded on Pinchot’s philosophy that trees are a crop that could be managed and reestablished after harvesting.

Underlying Economic Forces and the Culture of the Lumber Industry (1880-1930)

Descriptions of logging activity, technology, and the volume of production provide only a superficial picture of the lumber industry during the late nineteenth and early twentieth centuries. The obvious underlying motivation for the industry was money and the period during which railroad logging technology was employed in Pennsylvania was heavily competitive and unforgiving. The establishment of huge railroad logging operations with thousands of miles of track and magnificently constructed viaducts were remarkable engineering feats, but also reflect the entrepreneurial greed and competition that is found in most large American industries of the same period. In his book *Lumberjacks and Legislators*, William G. Robbins states that the lumber industry “was of paramount importance to the rise of industrial capitalism in the United States [and it] provides key insights into the evolution and expansion of industrial capitalism in the nineteenth and twentieth centuries.”

...between the end of the Civil War and the first decade of the twentieth century, the industry suffered from dislocation, chronic overproduction, cutthroat competition, and a generally unstable market. These chaotic conditions were related to mercurial and unstable market forces that capitalists, individually and collectively, were unable to control. In the case of the lumber industry, improvements in transportation, increasingly sophisticated methods for felling timber, and an even greater revolution in the technology of milling lumber generated a tremendous expansion in the productive capacity of the industry. The consequences were overproduction, glutted markets, and a social-Darwinian struggle for survival that often resulted in extravagant waste, a devastated environment, and decaying communities (Robbins, 1982:5-6).

The appearance of corporations, trusts, and trade associations also reflects the extreme competition in the lumber industry. “The critical elements for continued existence and financial success, at least as the progressive entrepreneurs viewed the world, included large-scaled operation, corporate organization, cooperation between associations, and effective influence over the political process and the emerging regulatory agencies” (Robbins, 1982:6). The lumber industry was optimistic that legislation and government policy were the answers to creating stable conditions and a predictable market, conditions under which simple logic and common sense would lead to economic success (Robbins, 1982).

Advances in technology during this period greatly increased production of lumber and wood products, which considerably increased levels of competition. Government efforts to control production levels were unsuccessful, and the failure of trade associations to improve stability in the industry “suggests that [problems in the industry] could not be resolved without major structural changes in the social system” (Robbins, 1982:7). What ultimately alleviated the problem of over-production in the first decade of the twentieth century, however, was not a change in the values or culture of the lumber industry; rather, it was a diminished demand for lumber and wood products (Robbins, 1982)

Beginning primarily in the twentieth century, the lumber industry engaged in cooperative and respectful relations with federal and state land management agencies and officials from other executive and legislative branches of the government. The relationship between the lumber industry and government was based partly on the realization that for the "national and public interest" such cooperation was essential. US Forest Service ties to the lumber industry are still based at least partly in its early mission to provide forest resources to the American people in the form of timber sales, but also stem from the fact that professional foresters in private industry and government share a common vision of forest management and commercial forest product availability. "Such relationships marked the continuing integration of the lumber industry with the national economy" (Robbins, 1982:9). But not every government official, including the first chief of the Forest Service, Gifford Pinchot, supported the lumber industry's vision of forest management and commercial harvesting. The conservation movement of the late nineteenth and early twentieth centuries brought heated controversy to both Pinchot and the lumber industry. Some historians argue that members of the private lumber industry who supported forest conservation were actually supporting any policy that would regulate production and bring stability to the industry (Robbins, 1982).

The long and persuasive influence of the lumber industry... is more than the story of courageous river drives and the rise to wealth and power of individual lumber entrepreneurs. To understand the political economy of the lumber industry from 1890 to 1941 is to recognize power and influence used in a concerted effort to define and control the future. Lumber capitalists worked strenuously to shape a favorable economic environment. They asserted themselves in legislative halls and in the federal government's scientific bureaus; in these ways they exercised a controlling influence over regulatory policy (Robbins, 1982:15).

The Establishment of the Allegheny National Forest

In 1910, the majority of parks, reserves, and forests were located in sparsely populated western states. Because it was settled much earlier, no land in the northeastern states had been included in the 1891 designation of Forest Reserves. However, in 1911, with some difficulty, the Weeks Act was passed, allowing the federal government to purchase large tracts of land that had been the focus of intensive and extensive logging and mining operations, or land that had been otherwise discarded or was unwanted. Within Pennsylvania, there existed an opportunity to establish a National Forest from various tracts of land, many of which were previously owned by the Central Pennsylvania Lumber Company. On May 1, 1911, Pennsylvania made available a large section of land in the northwestern portion of the state to be included in the National Forest system (Wolyneec, 1978). It took several years before the value of the cut over land was assessed

by surveyors and foresters, but on September 24, 1923 the Allegheny National Forest was officially established. The newly designated National Forest had been so cut over and burned that it was nicknamed "The Allegheny National Brush Pile" and the "Allegheny National Briar Patch."

Despite the early doubts, the Allegheny National Forest has proven a valuable resource to the state. For example, research at the Kane Experimental Forest has been performed by the Northeastern Forest Experimental Station since at least the 1940s and has helped the Allegheny National Forest understand and manage the Northern Allegheny Plateau Woodlands. Also, the Forestry Sciences Laboratory located at Irvine, Pa. was established in 1959 and continues to conduct research on both the Allegheny National Forest and the Kane Experimental Forest (Frank, 1998).

Property Types: Except for structures built by the Civilian Conservation Corps, the Allegheny National Forest's administrative sites generally date to the period between 1955 and 1995. The Kane Experimental Forest, located on the eastern edge of the Allegheny National Forest, was established in 1932 and some features, including the "portal gates" at the entrance, date to the 1930s or 1940s.

Forest Fires and Fire Fighting in Pennsylvania: 1897-1950

The significant role of fire in Pennsylvania's forests cannot be overstated. In his 1982 book, *Fire in America*, Stephen Pyne wrote, "mankind is the primary source of fire in the world and is continually improving its capacity both to remove and to introduce fire in greater quantities than [ever] before." In the last decades of the nineteenth century, wildfires consumed as much as 350,000 acres of forests in a single year. Although most fires were attributed to railroads, sawmills, brush burning, and outdoorsmen, the causes of others were not determined, although humans were probably involved. Largely the causes were attributed to railroads, sawmills, brush burning and outdoorsmen, but the origins of many fires, though probably human-caused, were not identified. Legislative acts passed in 1897 increased authorities' ability to punish individuals who deliberately or accidentally set forest fires. Rothrock credited the March 30 and July 15 acts with reducing the loss of Pennsylvania's forests to wildfire (DeCoster, 1995).

The legislative acts of 1897 provided an incentive to practice fire prevention, but better methods of fire suppression were still needed. The 1909 Fire Wardens' Act authorized the commissioner of forestry to appoint fire wardens. Unfortunately, this act did nothing to eliminate the occurrence of forest fires and did little to help extinguish them. The easiest fires to extinguish

were the ones that were reported early. Thus, the key to protecting Pennsylvania's forests was to improve methods to quickly identify and report fires. In the first decade of the twentieth century, lookout towers built in tall trees and self-supporting wooden towers were manned during critical periods of the year, usually early spring and during September and October when forests were driest. In 1914, tall steel towers began to appear, linked by telephone with ranger cabins and nearby towers. Quicker communication substantially reduced response time, improving the effectiveness of fire suppression efforts (DeCoster, 1995).

Under the direction of Gifford Pinchot, the forestry department continued to wage war with forest fires. In 1920, Pinchot reported that "forest fires have reduced one-sixth of Pennsylvania to worthless barrens," (DeCoster, 1995). Earlier detection and reporting of fires were gradually decreasing annual losses. One of the worst fires of the 1920s was the May 17, 1926 Bear Creek fire in Elk County where over 20,000 acres burned (Schultz, 2000).

Some of the greatest accomplishments in fire suppression during the 1930s are attributed to the Civilian Conservation Corps. For example, after the CCC camps were established on the Allegheny National Forest, and the CCC fire fighters could quickly report to forest fires, no blaze exceeded 500 acres (Schultz, 2000). However, efforts of the CCC were still not enough to tame Pennsylvania's conflagrations. One of the greatest tragedies and losses of life during the history of the Civilian Conservation Corps occurred on the October 1938 Pepper Hill fire in Cameron County. A total of eight CCC fire fighters died while fighting in the Grove Township forest fire. A monument dedicated to the contributions and memory of these men is located on Pennsylvania Highway 220 between Emporium and Renovo.

During the 1930s and 1940s, the Pennsylvania Forestry Department continued their efforts to prevent and suppress forest fires, using wireless two-way radios to substantially assist the department in keeping Pennsylvania green (DeCoster, 1995).

During World War II, a nationwide effort to prevent forest fires was initiated. Forest fires not only meant lost resources, but the suppression of forest fires required manpower that could have been otherwise directed towards winning the war. In an effort to educate the public, the government and private industry launched three national fire prevention programs including the Keep Green Program, the Cooperative Forest Fire Prevention Program, and a short-lived program established by the Red Cross. Wartime fire prevention slogans such as "Careless Matches Aid the Axis" and "Your Match, Their Secret Weapon" appeared on posters. In the search for a fire prevention symbol, the Ad Council and the Wartime Council experimented with Bambi™, a squirrel, and a monkey, but finally settled on a bear. This idea came about in 1944, and by 1945 Smokey Bear was appearing on posters across the county. In 1947, Smokey's most popular expression "Remember, Only You Can Prevent Forest Fires" began to appear on posters

and could be heard on the radio. In 1950, a small black bear cub was rescued from a forest fire on the Lincoln National Forest in New Mexico. The little bear cub drew national attention and, with little Smokey Bear as the living version of the national fire prevention symbol, the message of fire prevention was successfully delivered to a wide audience (Pyne, 1982).

Pinchot's Contributions to Pennsylvania Forests and Forest Conservation

Having left the US Forest Service under difficult and controversial circumstances in 1910, Gifford Pinchot split his time between Washington, D.C. and Grey Towers, his home in Milford, Pa. Though the Pinchot family wealth allowed him to live at his leisure, Gifford Pinchot wished to return to the political arena. In 1912, he tested the waters of politics within Pennsylvania, and as a member of the Progressive Party, sought the office of US senator. After losing the senatorial race to a Republican, Pinchot returned to the Republican Party and vied for the party nomination for the 1920 senatorial election. Following two failed attempts to win a US Senate seat, he served two years as the Pennsylvania Forestry Commissioner under Governor William C. Sproul, during which Pinchot decided to run for governor (DeCoster, 1995).

Gifford Pinchot served two non-consecutive terms as Pennsylvania's governor, 1923-1927 and 1931-1935. After a successful first term, Pinchot again sought the seat of US senator, a race he lost along with his state governorship. After being re-elected as governor, Pinchot was faced with a completely different set of issues and problems. His first term successor, Governor John S. Fisher, had become known as "The Builder" for the volume of public works improvements and roads that were established between 1927 and 1929. Fisher, unlike Pinchot, did not share the concerns of blue collar laborers; and, when the Depression descended in 1929, his policies left the miners, farmers, and loggers to fend for themselves. As a result, "Pennsylvania did not share heavily in the prosperity of the 1920s, but shared fully in the poverty of the 1930s" (Klein and Hoogenboom, 1980). Wages declined to the point where workers in sawmills were reported to earn as little as five or six cents an hour (Klein and Hoogenboom, 1980). When Pinchot returned as governor in 1931, he was faced with impoverished Pennsylvanians desperate for a leader who was sympathetic to their needs.

During his second term as Pennsylvania's governor, Pinchot concerned himself with the outrageous cost of electricity charged by private power companies, the plight of Pennsylvanians during the depression, and the poor state of Pennsylvania's rural road system (Klein and Hoogenboom, 1980). Pinchot fought an unsuccessful war with Pennsylvania electric power companies, lobbyists, and state senators while attempting to establish a publicly-owned utility company that charged Pennsylvanians fair rates. He did, however, have some measure of

success with establishing paved roads throughout rural Pennsylvania. Pinchot was willing to settle for less than perfect roads at a lower cost if that meant a great deal more roads could be established or improved. Many of his roads “followed the contours of the land and consisted of a layer or two of stone covered by bituminous macadam” (Klein and Hoogenboom, 1980). Pinchot’s roads helped rural Pennsylvania residents, particularly farmers and loggers, connect with markets in larger cities and allowed easier distribution of farm products and other commodities such as logs and lumber.

Many of the “Gifford Pinchot roads” scattered throughout Pennsylvania were, and frequently still are, important “haul roads” for logging trucks. One such road is State Highway 666, which is located along Tionesta Creek within the Allegheny National Forest. Its bumps and curves are characteristic of the many Pinchot roads built during the 1930s.

In 1908, a million acres of Pennsylvania’s forests burned, and, in an effort to protect their investments, the state’s private logging industry established a protective fire association, assisted in the prevention of fire, and helped establish fire towers (Pyne, 1982). In the early 1910s, the Pennsylvania State Forestry Commission had identified the need for improved forest fire detection methods and established lookouts at high points, including primitive tree-top lookouts and wooden towers.

Gifford Pinchot was also concerned about Pennsylvania’s forest fire detection program; and during his first term as governor, he directed \$1 million towards the expansion of the fire lookout program, which financed the construction of fifty 60-foot tall steel fire towers complete with telephones. Pinchot’s new fire towers supplemented the existing 24 steel towers, 25 wooden towers, and 44 tree towers located on state forests, and 46 steel towers and 14 wooden towers located on private land. The forestry department also employed men to staff the towers, and had numerous patrolmen, fire bosses, forest-fire wardens, and inspectors (DeCoster, 1995).

Pinchot’s initiative to improve roads also extended to the improvement of roads within state forests. In the early 1920s, almost 200 miles of forest roads were built and well over 1300 miles of old road were repaired. The improved road system aided the suppression of fire, as did many miles of road that were developed as fire lanes or fire breaks (DeCoster, 1995).

Other notable resources associated with Pennsylvania’s forests include tree nurseries, many of which predated Gifford Pinchot’s term as governor, and administrative sites. Many of the early nurseries weren’t always successful and most of them have been forgotten (Day, 2000).

Property Types: Historic forest properties that date to Gifford Pinchot’s term as Pennsylvania’s governor include fire towers and a network of rural roads. Camp Elliot, located in Clearfield

County is an example of an administrative site or forestry camp built by the state.

Pathogens Attack: Chestnut Blight and White Pine Blister Rust

Pathogens have formidable potential to afflict native plant species. Chestnut blight and white pine blister rust were two pathogens that significantly affected Pennsylvania's forests beginning in the early twentieth century

Chestnut Blight

The Chestnut blight fungus (*Cryphonectria parasitica*) was first discovered in the U.S. in 1904 at the New York Zoological Park. The disease rapidly spread, killing American chestnut trees (*Castanea dentata*) in New York City parks, continuing through the Long Island Sound, and arriving in Pennsylvania in late 1908 (DeCoster, 1995). Chestnut blight swept through forest stands in Pennsylvania and lasted through 1913.

The *Cryphonectria parasitica* fungus functions by entering tree wounds, growing in and under the bark, and killing the cambium all the way around the twig, branch, or trunk (Anagnostakis, 1996). Because of its effortless mobility, the spread of the blight continued until nearly all American forest stands were afflicted (DeCoster, 1995). By 1952, all of the large chestnut trees in the Appalachian forests had been killed (Odum, 1983).

Prior to the presence of chestnut blight, nearly 20 percent of the forest trees in Pennsylvania were American chestnuts. The trees were a dominant and valuable resource in the Commonwealth, used for fence rails, railroad ties, poles, and aesthetic purposes. Nuts from the trees provided food for both wildlife and humans. Since the chestnut blight, oak species have primarily filled the tree's niche (DeCoster, 1995).

In 1911, the Pennsylvania Forestry Department worked to set up a field organization to control the spread of the disease. However, a month later, a national Chestnut Commission was formed, and the Pennsylvania field organization joined with the Commission. By 1913, the blight was declared too far advanced and hundreds of thousands of legislative funds had gone by the wayside (DeCoster, 1995). In 1972, a biological control imported from Europe would allow the breeding of chestnut trees; however, as of 1996, the control had not been used for forest growth of chestnuts (Anagnostakis, 1996). At present, seedlings are quickly plagued by the cycle of the chestnut fungus allowing no trees to grow to maturity.

White Pine Blister Rust

White pine blister rust began taking its toll on northeastern white pines (*Pinus strobus*) in 1905. The fungus (*Cronartium ribicola*), most likely imported from Europe, finds its way initially on young white pines with branches close to the ground. Blisters will develop on the stems of the young trees, eventually killing the white pines as the blistered areas encompass their vascular system. When the blisters burst, orange spores are disseminated into the air finding an easy travel route to another host (DeCoster, 1995). White pine blister rust, however, does not afflict trees as readily as chestnut blight. The white pine fungus first needs to pass through a life stage on an intermediate host, primarily currants and gooseberries (*Ribes sp.*) (DeCoster, 1995).

The white pine blister rust fungus was first reported in Pennsylvania, near Philadelphia, by the Pennsylvania Department of Forestry in 1905 and was purportedly conquered by 1921. As a result of its gradual spread, the fungus may appear dormant or extinct for extended periods. This proved to be the case in Pennsylvania, and by 1927 blister rust riddled the state's white pines again (DeCoster, 1995).

Initially, the primary management strategy for controlling or conquering the blister rust was to obliterate its alternative hosts. A major campaign by work crews and school children in Pennsylvania commenced in the late 1920s to discard all gooseberry and currant plants. This proved to be a colossal task. The Pennsylvania Department of Forests and Waters assumed all authority in 1933 over pine rust control through the Pennsylvania White Pine Blister Rust Law. However, by 1972, efforts to control the fungus had been terminated because of recent knowledge that (1) all ribes plants could not be removed from pine forests and (2) the disease functionally spread slowly, and not all pines would be afflicted with the disease (DeCoster, 1995).

According to Katovich and Mielke (1998), one of the best management strategies for white pine blister rust is simply to manage young white pines under an existing overstory. Because the overstory decreases the formation of moisture on pine needles, a prerequisite for rust production, not as many trees will be afflicted. Additionally, because most infections occur within nine feet of the ground, pruning lower branches of white pine will help reduce losses.

The Civilian Conservation Corps

Throughout history, prosperous periods are often followed by catastrophic events or crises, which are followed by periods of recovery and equilibrium. America's Great Depression of the 1930s was no different. Historians have investigated every aspect of the cause of such depressions or "price revolutions" and set forth myriad theories to explain the sudden appearance of the Great Depression. One explanation is that the inequalities between classes in the 1920s led to a drop in consumption of goods except by a small, wealthy minority. The drop in consumption caused instabilities in major industries from insufficient demand, a decline in the purchase of houses and cars and a widespread drop in commodity prices, including lumber, oil and food. Regardless of the cause, the American stock market plummeted almost overnight, wages fell, and unemployment levels skyrocketed (Fischer, 1996).

President Herbert Hoover did not effectively administer first-aid to a despairing country during the early years of the Great Depression and lost the 1932 presidential election to Franklin Delano Roosevelt, whose platform of a "New Deal for the American People" and a "crusade to restore America to its own people" was more appealing than anything Hoover had to offer (Anonymous, n.d.). Within the first 99 days of his first term, President Roosevelt set to work on "Three Rs": reform, relief and recovery. During four terms as President of the US between 1933 and 1945, Roosevelt created at least 34 agencies, corporations, administrations, programs, or boards in an effort to meet the needs of the American people and establish stability and equity in all aspects of government, the economy, society and the environment.

The Civilian Conservation Corps (CCC), created on April 4, 1933, was one of the largest programs ever instituted by Roosevelt in terms of manpower (Kennedy, 1996). He intended to employ strong young men to rebuild the country's forests, perform flood control, and work on beautification projects. At the time, no one could have predicted the success of the CCC, or the volume and diversity of projects that they would accomplish before the program's dissolution on June 30, 1942.

The CCC commonly worked on projects on federal land such as National Forests and National Parks, but in Pennsylvania they worked on state forests and parks as well. The CCC also teamed with a diverse group of land and resource management agencies such as the Forest Service, the Park Service, the Bureau of Reclamation, the Fish and Wildlife Service, the Soil Conservation Service, the Tennessee Valley Authority, and the General Land Office. Agency personnel supervised particular projects, but often the CCC members were left to design and implement projects independently. Retired or inactive US Army officers were employed to discipline, train, and supervise the CCC, providing a further boost to the nation's economy. Many of the officers and supervisors were from local communities and were familiar with the terrain, roads, and

challenges of the projects (Nocera, 1997).

A CCC company usually consisted of 200 men who had passed a rigorous health inspection prior to admission into the corps. The initial eligibility required a CCC "boy" to be unemployed, unmarried, and 18 to 25 years old, but this was later extended to include veterans of World War I (Cohen, 1980). Because of the employment opportunity and the enjoyable outdoor lifestyle, it was not unusual for younger and older men to gain entrance into the CCC by lying about their age (Nocera, 1997). The enrollees enlisted for six months and were later eligible for another six month enlistment (Cohen, 1980). Even though the pay was minimal – an enrollee was paid \$30 a month with the condition that \$25 would be sent to his family – a position in the CCC was desirable at a time when unemployment figures were high. The CCC assisted both the recovery of the environment and the relief of enlistees' families, fulfilling two of Roosevelt's three Rs. An important side benefit of the program was the education of tens of thousands of young men in practical and intellectual disciplines such as surveying, electrician, and radio generation, which, during World War II, proved to be a valuable asset for many of the enrollees as well as for the country (Nocera, 1997).

The CCC boys tackled a multitude of projects, including the establishment of recreation areas, fire towers, tree plantations, roads, bridges, fences, firebreaks, telephone lines, trails, dams, irrigation channels, and flood control and soil loss structures. They were responsible for fighting forest fires, as mentioned above, and most companies had a designated initial attack fire crew that responded to both lightning strikes and human-caused fires (Nocera, 1997). They also provided assistance in disasters and floods. The CCC conducted restoration of historic structures and archaeological excavations prior to establishment of dams and built museums in at least five states (Cohen, 1980).

In August 1933, there were 97 CCC camps within Pennsylvania, second in number only to California. Fourteen of these were established in the then ten-year-old Allegheny National Forest (Cohen, 1980). One of the best known of these camps – variously known as Camp 1, Duhring, or Pebble Dell - was the second CCC Camp in the United States. Some claim that Camp 1 would have been the first camp in the nation if Camp Roosevelt, near Edinburg, Virginia, hadn't been quickly established in response to President Roosevelt's desire to visit a camp near the White House (Shultz, 1998). Regardless, Pennsylvania's Camp 1 is the oldest standing CCC Camp in the nation. The Allegheny National Forest also boasts the first CCC plantation, a red pine plantation known commonly as Pebble Dell, which is located near the village of Pigeon, in Forest County (Dyer, 2000).

In the Allegheny National Forest, the CCC is also credited with the establishment of several recreation sites including Loleta, Beaver Meadows, and Twin Lakes. The CCC planted at least

7000 acres of conifers in the Allegheny National Forest, of which at least 5000 still exist in the form of mature stands of trees now managed by the US Forest Service. They also established Forest Service administrative sites, forest ranger residences, and fish hatcheries such as the Farnsworth Fish Hatchery in Warren County.

Beyond the National Forest, the Pennsylvania state park and forest system also contained numerous CCC camps. Within the fifteen-county Lumber Heritage Region, most of the state parks had CCC camps, recreation sites, fire towers, and roads, many of which still exist. If not for the CCC, Pennsylvania's state parks could not have afforded the facilities that have been the focus of recreational activities, since no other entity could have constructed such substantial and durable dams, picnic facilities, and buildings for such an insignificant cost. Some of Pennsylvania's most notable CCC recreation sites include Parker dam, S. B. Elliot State Park, the Black Moshannon dam and recreation site, the Clear Creek State Park recreation site, Hyner Run State Park, several picnic areas at Cook Forest State Park, the Kettle Creek State Park recreation area, the Little Pine Creek picnic area, and the Ole Bull State Park recreation area. As a living monument to the work done by the "boys", surrounding most of the CCC recreation areas and former CCC camp locations, there are stands of regularly spaced red pines or spruce trees.

Property Types: Within the proposed Lumber Heritage Region project area, the most common Civilian Conservation Corps site types include CCC camps ("permanent" and temporary tent camps), recreation sites, plantations, CCC roads, administrative structures, and fire towers. There are also a few documented CCC quarry sites, foundations, depressions, and artifact scatters, as well as fire towers, and culverts. A total of 94 CCC-related sites were documented during the inventory.

Many CCC camps had a standard layout with barracks, mess hall, and parade grounds in predictable locations. However, at least two Pennsylvania camps (Camp 7 located near Kane, and State Camp 75 at Hyner Run) also had ornamental water fountains (Gasparine 2000). Other camps had distinguishing characteristics such as fireplaces and walls constructed from local materials.

It is widely known that the CCC built many fire towers, some of which are located on a 1951 map of Pennsylvania's parks, recreational areas, towers, and monuments (Department of Forest and Waters, 1951). Five of the 58 towers within the Lumber Heritage Region planning area were operated or owned by the federal government (i.e. the Allegheny National Forest), and the remaining 53 are presumably on state land. Four of these are known to have had associated tower "huts" or dwellings, including the Whetham, Coffin Rock, Tamarack, and Panther towers (Davies 2000). It is likely these dwellings, were also constructed by the CCC.

Works Progress Administration

The Works Progress Administration (WPA) was another work-relief program established by President Roosevelt during the Great Depression. Because it was established two years after the initial New Deal programs, it was occasionally billed as the "Second New Deal," - one of the most massive and comprehensive efforts ever undertaken in the nation's history up to that time to ensure that every able-bodied American male - and even some able-bodied American females - would be able to earn at least the basic needs of life for themselves and their families" (Watkins, 1993). During the 7 years of its existence the WPA employed nearly 9 million people and participated in nearly 1.5 million different projects (Watkins, 1993). It surpassed even the CCC in the number of public works projects and individuals employed. Whereas the CCC generally worked in rural areas on unimproved public land, WPA projects were more frequently located in urban areas and its enrollees built highways, large bridges, airports, streets, and buildings.

Within the Lumber Heritage Region, the WPA is known to have established recreation sites or improvements in three Pennsylvania state parks, including Bendigo State Park in Elk County, Black Moshannon State Park in Centre County, and Parker Dam State Park in Clearfield County (Bureau of State Parks, 1992). Additionally, with the WPA improvements to highways across the nation, people increasingly visited state and federal parks and forests, which for many Americans were the only affordable source of recreation during the Great Depression.

Property Types: Within the Lumber Heritage Region, the WPA established park facilities such as picnic areas and bathroom facilities.

The Rural Electrification Administration

In addition to the CCC and WPA, the Rural Electrification Administration (REA), established in 1935, played a significant role in improvements available to rural communities. One of the few New Deal era programs still in existence, the REA brought cheap power to rural areas through the use of numerous publicly-owned, non-profit electrical cooperatives. Electricity was used to some degree in sawmills and other wood-related industries for lighting and operation of machines with small motors (Brooks, 2000).

Property Types: Though no resources relating to the REA were documented during the inventory of historic and cultural sites, it is probable that they exist. Property types connecting the REA and the lumber industry include the numerous power poles used to string electric lines,

structures associated with the generation or transfer of electricity, and structures associated with the local administration of the REA or the local electric company cooperatives.

Wartime Forestry

The US officially entered World War II in December of 1941. But prior to the formal declaration of war, the US economy responded with lower unemployment figures and a sharp increase in industrial production. This fact, combined with President Roosevelt's preoccupation with the military, drew his attention from domestic issues and resulted in the decay and dissolution of many of his New Deal programs. Government reform and relief programs for the poor were abandoned and poverty levels increased despite the rise in wages. Smaller companies and businesses were unable to compete with larger corporations for the government contracts that were the source of most of the nation's jobs and income. As Americans migrated to large cities for employment during the war, the US became increasingly urbanized, creating an even greater shortage of workers in rural areas (Schultz, n.d.).

During the war, Pennsylvania provided a substantial supply of raw and finished goods including war vessels, ammunition, and a wide variety of wood and wood-related products. For the three years between 1942 and 1945, over a 100 million board feet of timber was cut on state forests for the war effort (DeCoster, 1995). Pulp wood was in demand for making paper, smokeless explosive powders, and for cellulose used in wood-derived plastics. Because unemployment was low, only a small workforce was available to manage or harvest trees from the late 1930s until the end of the war in 1945. State and federal governments took advantage of the availability of Prisoners of War (POWs) and conscientious objectors who were enlisted to do manual labor on state and federal land. POW camps were established at three former CCC camps within the Allegheny National Forest, including Camps 1, 3, and 4. POW camps were also established on former CCC camps at Lyman Run and Bark Shanty on state land. POWs are known to have established a number of tree plantations and conscientious objectors are known to have spent long days cutting firewood in the woods near Duhring between January 15 and April 15, 1943 (Burkett, 1998). Conscientious objectors, who for religious reasons declined to join the military, were known to have been located at the Duhring Camp 1 in the early 1940s (Burkett, 1998).

Property Types: The plantations established by the POWs are so similar to the CCC plantations that they are difficult to tell apart, unless the year that they were planted is known. There are no structural resources known to be specifically established or constructed by the conscientious objectors within the Allegheny National Forest.

End of World War II and the Return to a Peacetime Economy

On April 12, 1945, President Franklin D. Roosevelt died, leaving Harry S. Truman to serve as president and support the nation in the final months of the war. With Germany's surrender, the Allied Forces celebrated Victory in Europe Day on May 8, but fighting did not officially come to an end until Japan's surrender in Tokyo Bay on September 2, 1945. Following the withdrawal from Europe and the South Pacific, the nation began to demobilize its war industry and settle into a peacetime economy (Klein and Hoogenboom, 1980). In anticipation of the war's end, the Pennsylvania legislature had created the Post War Planning Commission to help Pennsylvanians during this period of transition. Unlike Pinchot, Governor General Edward Martin did not support state or federal relief programs and determined that Pennsylvania already had a sufficient set of such laws. Although he supported several health care acts, increased pay for teachers, and several conservation-related legislation acts, Martin's term in office from 1943 to 1947 was characterized by minimal governmental intervention or action. He did, however, support legislation to conserve Pennsylvania's natural and historical heritage (Klein and Hoogenboom, 1980). In 1945, Governor Martin also helped enact the Brunner anti-stream pollution act and helped establish the Pennsylvania Historical and Museum Commission.

With the conclusion of the war, rations were lifted on supplies such as meat, sugar, coffee and as all kinds of commodities and goods became abundant, Americans spent money freely for the first time since the 1920s (Schultz, n.d.). The forest management and wood products industries had access to army surplus equipment and trucks, which were used for hauling logs and lumber throughout the late 1940s and into the 1950s (Brooks, 2000). Although horses were still used in logging operations, the motorized equipment had a large impact on the ability to manage and harvest trees.

Since the relatively prosperous 1920s, Pennsylvanians endured the economic crisis of the Great Depression and had rebuilt their economy during World War II. Nearly at the midpoint of the century, Pennsylvania had a healthy economy and was ready to settle into a long period of stability and prosperity that would continue for the next 55 years.

*Lumber Heritage Region
Draft Historic Contexts*

A Second Forest and a Sustainable Approach: Modern Forest Management (1945 to present)

Thematic Statement: The modern forest management era begins with the close of World War II and the return to a peacetime economy. Shortly after the war, state and federal agencies began to assess the condition and value of Pennsylvania's forests, while private lumber industry activity was very limited. As Pennsylvania's hardwood forests began to mature, state, federal, and private land owners increased efforts to manage and cut the secondary growth. During this time period, the public gains a greater interest in the management of public forest land and in response, many new environmental laws are enacted.

The Emergence of Pennsylvania's Hardwood Forests

With the efforts of the Pennsylvania Bureau of Forestry, the Civilian Conservation Corps, other federal relief agencies, and a few decades of rest, the rural lands of Pennsylvania began to yield a rich supply of secondary forest growth. While the forest cover first used by nineteenth century timber men was primarily a mix of eastern hemlock, white pine, and beech trees, this secondary growth was a complex mix of Allegheny hardwoods, including the valuable black cherry (Marquis, 1975).

Privately-owned logging operations of the 1930s and early 1940s, though of a comparatively smaller scale than those of the previous three decades, had begun to take advantage of an increasing array of mechanized technology. Although trucks had been available since the first two decades of the twentieth century and roads had been considerably upgraded since 1920, it was not until after World War II that an explosion of technological advances in logging equipment substantially revolutionized the logging industry.

Immediately following the war, the Pennsylvania Bureau of Forestry was in a "tending mode," and by the late 1940s and early 1950s began to take a comprehensive inventory of Pennsylvania's forest resources (Day, 2000). By the 1960s, Pennsylvania's Department of Commerce and the Department of Forest and Waters recognized the value of the second growth hardwood forests and pursued economic development and full utilization of the state's forest resources. Revolutionary advancements in equipment, especially in the technology of hydraulics, significantly increased the efficiency of logging operations (Day, 2000). It was also

during the 1960s that there was a significant increase in the amount of scientific research on forest resources and forest health. Concurrently, the lumber industry, and lumber retailers in particular, began to use marketing techniques to increase the sale of wood products. Concurrently, the Bureau of Forestry and the US Forest Service developed detailed forest management plans for growing and harvesting timber.

In the 1970s, both agencies began to take into account the value of non-commercial forest resource, such as scenic byways, wildlife viewing and cultural resources. In the 1980s and 1990s, forest management practices became more holistic, incorporating non-timber forest products, such as ginseng, pine cones, and berries, as well as other resources. Also in the 1980s, special interest groups and private citizens began to express increased interest in the management of state and federal forests. In the last decade of the twentieth century, the Pennsylvania Bureau of Forestry and the US Forest Service began to more fully develop avenues to interact with interested constituents. It was also during this decade that significant improvements in information-age technology helped land management agencies and private industry address complex issues, carefully manage Pennsylvania's forests, and meet a wide variety of demands.

In comparison to earlier lumbering eras, the modern forest management era is markedly more complex. Because of this complexity and the issues and events that are shaping this context even as this document is being prepared, this chapter addresses only a few of the more significant factors and elements that shaped Pennsylvania's modern hardwood forest and its industries during the last fifty years.

Technology Advances in the Logging Industry from 1945 to 1999

Historically, the logging industry has been an integral part of a growing nation. With the persistent need and demand for wood and wood products, the logging industry responded by supplying consumers as quickly and efficiently as possible. Technological advances were few at first and transportation systems limited import of supplies and the export of goods. Toward the midpoint of the nineteenth century, the industry-perfected techniques of water transport through the use of log rafts and log drives. The development of the steam engine and the railroad provided another means of transport, and by the 1880s railroads became indispensable. With the invention of an internal combustion engine near the close of the nineteenth century, and an increase in oil and petroleum refineries, the trucking industry soon became an essential part of logging operations. Innovations in saws, sawmills, and other mill equipment also improved the ability to produce lumber and other goods.

Following World War II, there were measurable gains in the quality and availability of mechanized equipment, which greatly simplified many logging operations. Trucks were more frequently used in logging operations following the war, and rubber-tired skidders and knuckle boom loaders appeared in Pennsylvania forests in the 1960s (Brooks, 2000). Chainsaws became safer and lighter, and were made from better and more durable steel alloys. Whereas pre-World War II chainsaws were powered by heavy DC motors and required burdensome electric cords, the saws of the 1950s, 1960s and 1970s were gas-powered and much more portable (Day, 2000). The number of improved logging roads reduced haul time and minimized wear on trucks and other equipment. State and national forests also benefited from the availability of the more gentle rubber-tired skidders and other logging equipment that generated less soil erosion. In addition, state and federal forests had access to mechanized site preparation equipment such as hydro-axe machines, efficient herbicide deploying machines, and air support for aerial photography, insecticide spraying, and fire suppression. Late twentieth century technology improvements, including the use of computers and other “smart” machines are continually applied in the logging industry (Day, 2000). In fact, with the use of Geographic Information System and Global Positioning System technology, some modern logging operations have turned the logging industry into a “white collar” industry (Day, 2000). With few exceptions, the sophistication and technology of modern logging industry operations present a sharp contrast to the logging operations of the last three centuries.

Fire Prevention Efforts In Pennsylvania Since World War II

The fire prevention campaign established during World War II helped to drastically reduce forest fires. Within the state of Pennsylvania, the fire prevention message was especially critical since less than 1 percent of forest fires are caused by lightning (Pyne, 1982). Despite public awareness, Pennsylvania firefighters were continually summoned to suppress fires with basic equipment such as gasoline-powered water pumps, shovels, axes, backpack spray tanks, and fire rakes. As early as 1932 airplanes were used to patrol for forest fires, but it was not until April, 1960, that Pennsylvania used airplanes for dropping water on fires (DeCoster, 1995). Pennsylvania was one of the first states to use aircraft to suppress fires and in 1969, over 350 fires were put out with the aid of air tankers (DeCoster, 1995).

Re-introducing Fire to Eastern Woodland Forests

Fire had been a critical element in the maintenance of Pennsylvania’s predominantly hemlock, beech, and white pine forests prior to Euroamerican settlement. Increased settlement in central and northwestern Pennsylvania, and subsequent extensive logging operations, created a reduction

in fire occurrence and increased the amount of dry, dead wood and slash. This elevated the potential for extreme, catastrophic forest fires. In a reversal of one of their most important policies, in place since the early 1900s, the US Forest Service has recently begun to use “prescribed burns” to reduce fuel levels and reduce the potential for catastrophic wildfires. The Allegheny National Forest is gradually, strategically returning the element of fire to the new eastern hardwood forests as a preventative measure to protect natural and cultural resources, and to safeguard rural communities adjacent to federally managed land (Dyer, 2000).

The Dynamics of Deer Populations and Effects on Pennsylvania's Forests

Wildlife, and in particular the white-tail deer (*Odocoileus virginianus*), has had an important role in shaping the character and makeup of Pennsylvania's forests. In the early 1640s, Swedish settlers established fur trading forts in what is now southeastern Pennsylvania, and in eastern Pennsylvania along the Schuylkill River. The first Europeans to arrive in Pennsylvania trapped and traded beaver pelts, as well as furs from bear, deer, otter, and raccoon. The trappers rapidly decreased the populations of fur-bearing animals and, in their quest for more furs, pushed north and westward into territories belonging to various eastern Native American tribes. The conflicts that arose between the Europeans and Native Americans and the skirmishes between different tribes are collectively referred to as the Beaver Wars, circa 1634 to 1670 (Kosack, 1995; Richter, 1992; Snow, 1996). With the dispersal and removal of the indigenous populations of wildlife in the mid-1600s, the European newcomers set in motion a series of dramatic changes to the eastern woodlands of North America. Despite the significant changes that had already taken place, William Penn's assessment of the new land was still very favorable. When Penn first encountered Pennsylvania in the fall of 1682, he counted the fish, beaver, raccoons, turkeys, pheasants, elk, and deer as part of the new land's wealth (Kosack, 1995).

By the early eighteenth century, populations of deer within the colonized portions of Pennsylvania had dramatically diminished. With the concern for protecting the deer population, which served as a significant supply of fur and meat, Pennsylvania's Provincial Governor, Sir William Keith enacted the first hunting restrictions (Kosack, 1995). During the same period, northern and western portions of Pennsylvania still had ample deer populations, and fur traders continued to push westward, setting the stage for the French and Indian War of the late 1750s and early 1760s. In 1760, an act of legislation was designed to eliminate conflicts between settlers, trappers, and Native Americans. This law restricted Euroamericans from hunting on Indian land, but was generally ignored.

The land purchases from the Native Americans in the latter part of the eighteenth century subsequently established easier access to land and wildlife resources for new settlers. By the end

of the eighteenth century, Pennsylvanians had access to more than 48,000 square miles, much of which still had vast timber resources and a considerable deer population.

In the twentieth century, whitetail deer research identified irregularities and overpopulation in Pennsylvania deer herds (Kosack, 1995). In 1949, the PGC recommended that “for the good of the forests and for the good of the deer themselves” [the PGC] “is faced with not harvesting but controlling them with the same determination with which we attempt to control any undesirable species” (Kosack, 1995:107). “The whitetail’s impact on the forest and other forest animals became more severe as Pennsylvania’s logged-off woodlands began to mature. The seedlings and saplings that followed logging activity had provided abundant browse and had supported large numbers of deer”(Kosack, 1995:115). Whereas the “deer problem” at the turn of the century was a lack of deer, mid-century game commissioners and wardens were faced with a surplus of deer that had the potential to severely overbrowse, harm the forests, and other wildlife, and face starvation when forage resources were completely consumed. The PGC reacted by instituting an education program and promoting an antlerless deer hunting season. Throughout the 1960s, 1970s, 1980s, and 1990s, the PGC has monitored deer populations and prescribed hunting permits based on population density and carrying capacity. Figure 1 displays the averages of antlered and antlerless harvests over the past eight decades.

<u>Time Period</u>	<u>Avg. Antlered Harvest</u>	<u>Avg. Antlerless Harvest</u>	<u>Avg. Total Harvest</u>
1915 – 1920	2,121	CLOSED	2,121 (All antlerless harvests closed)
1921 – 1930	11,270	5,589	13,516 (1 closed antler, 4 closed antlerless)
1931 – 1940	26,355	89,749	70,622 (1 closed antler, 5 closed antlerless)
1941 – 1950	29,315	33,242	49,259 (4 closed antlerless harvests)
1951 – 1960	40,004	41,998	73,603 (2 closed antlerless harvests)
1961 – 1970	55,586	43,725	102,570 (no closed harvests)
1971 – 1980	66,395	57,786	124,180 (no closed harvests)
1981 – 1990	117,917	136,584	254,502 (no closed harvests)
1991 – 1998	165,974	222,521	388,520 (no closed harvests)

Figure 1. Average antlered and antlerless deer harvest over 83 years. (modified from PGC, 2000).

As the Twenty-first century begins, deer herd management has taken a decidedly different track. The PGC, through an extensive public outreach education program, has garnered sufficient support to change the focus of herd management from maintaining elevated harvest rates to maintaining a healthy ecosystem. The new herd management policies, which are being enacted through major changes to season lengths and harvest limits, attempt to improve the health and overall quality of the deer herd statewide by lowering the number of deer in overburdened habitats. Although it may be several years before the results of this policy shift are seen in the LHR, the potential to benefit forest health – by

eliminating overgrazing, restoring a more diverse understory, and allowing greater natural recruitment of young hardwoods –is immense.

Pennsylvania's Elk Herd: Past and Present

In a reversal of the active role that Pennsylvania's deer herds have had in establishing the current composition of Pennsylvania's forests, Pennsylvania's wild elk population has been a barometer of the condition of Pennsylvania's forests. Once an important part of Pennsylvania's prehistoric and historic ecosystem, elk roamed and foraged on the edges of wooded land. Along with the white-tailed deer, the elk were valued for their meat and by the early 1800s, elk had been extirpated from southeastern Pennsylvania and were rarely found west of the Allegheny River. By the mid-nineteenth century, the remnant Pennsylvania elk herd was confined to northcentral Pennsylvania in Cameron, Elk, and McKean counties (Kosack, 1995).

The last of Pennsylvania's native elk was shot in 1867, near the town of St. Marys in Elk County, and it wasn't until 45 years later that the PGC pursued herd reestablishment. In 1913, the first 50 elk were brought from Yellowstone by train and released in Clearfield and Clinton counties. Another shipment of 22 elk was released in Monroe and Centre Counties. Two years later, another 95 elk were released in Cameron, Carbon, Potter, Forest, Blair, and Monroe counties (Kosack, 1995).

Reintroduction of elk seemed like an effective way to help the Yellowstone National Park solve their excess elk population problem, as well as a method to replace an element of Pennsylvania's ecosystem that humans had carelessly eliminated. The reintroduction of elk in Pennsylvania was not embraced by everyone, and farmers particularly objected to the idea. After release, the elk ranged as much as 40 miles and were difficult to keep away from agricultural land. Angry farmers often shot the elk when they caused crop damage (Kosack, 1995).

In the early 1920s, a limited number of elk hunting permits were granted for herd management. By 1928, the Pennsylvania elk herd was restricted to only Elk and Cameron counties. The problems associated with elk herd management, including crop damage, were discouraging for the PGC and seemed to outweigh the value of the reintroduction program. By 1932, the annual elk hunt was eliminated. During the 1970s, a proposed 10,000-acre elk management area in Elk and Cameron counties brought additional controversy and objections from farmers which led to the PGC's adoption of their first formal elk management plan in 1976 to assist the elk and avoid complications with farmers and private land owners (Kosack, 1995).

Despite exhaustive measures to carefully manage the elk herd and its habitat, the health of the herd declined in the early 1970s. Researchers at Penn-State identified a parasite that reduced the

population to as low as 38 individuals. Surprisingly, the herd seemed to improve on its own and by the early 1980s, it had stabilized and began to increase at a rate of 15 to 20 percent annually (Kosack, 1995).

Today, the health and location of Pennsylvania's elk herd is closely monitored by the PGC and the Bureau of Forestry. In early spring of 2000, the PGC's annual survey reported an estimated 566 elk roaming the Susquehanna Valley near Kettle Creek Valley, Tamarack Village, Bitumen, Keating, and Sinnemahoning (Sproul State Forest, 2000). The elk continue to be a focus of interest for researchers, foresters, and the public. Once completely eliminated from Pennsylvania's forests, the reintroduced elk herd, the easternmost wild elk in the US, is now an important component of Pennsylvania's heritage and current cultural landscape. In fact, in 2000 the PGC has proposed the first elk hunt in Pennsylvania in nearly 70 years.

Post World War II Forestry Science and Forest Management 1945-1999

During the Great Depression and World War II, conservation of forest resources was a secondary concern to the economic revitalization and war efforts. By the mid to late 1940s, however, federal and state agencies began to assess the value and content of Pennsylvania's forest lands. Agency personnel were well aware of the history of Pennsylvania's rapid deforestation and subsequent forest fires, and were concerned that Pennsylvania's forests might not be able to meet present or future wood product demands.

Between 1949 and 1955, in cooperation with the Pennsylvania Department of Forests and Water, the US Forest Service's Northeastern Forest Experiment Station conducted a survey of Pennsylvania's forest resources. The focus of the study was to determine the volume and content of Pennsylvania's forest resources and to determine if they would adequately supply present and future demands. The study found that between 60 and 77 percent of Pennsylvania's central and northern counties were forested. The study also reported that 78 percent of Pennsylvania's forests were privately owned. Although lumber, coal, and oil companies owned large tracts of forest land, over half of the privately-owned forest land was held by individuals who had a 100 or fewer acres. State forests, game lands, and other state-owned forests comprised 18 percent of the commercial forest lands then available. The Allegheny National Forest, with over a half million acres, comprised only 4 percent of Pennsylvania's commercially available forest land (Ferguson, 1958).

The study was the first survey of Pennsylvania's resources since 1926 and helped forest resource agencies and private industry manage forest resources and obtain optimal timber harvests. The study verified that Pennsylvania's commercial forest lands contained 95 percent hardwood tree

species. Within the Lumber Heritage Region, the predominant species of the second growth forest had become black cherry, beech, sugar and red maple, red oak, and ash. The black cherry was more dominant in the northern and western counties, and the red oak was more often found in the central and southern counties (Ferguson, 1958).

The study evaluated the potential of Pennsylvania's forest lands to contribute to the state's economic growth, and reported that, while Pennsylvania ranked high among producers of timber in the northeast, it still consumed four times more wood products than it produced. The study also looked at the age, quality, and stocking (volume) of forest stands to assess the potential supply of saw timber and pulpwood. Tree mortality and waste were also assessed. The study ultimately offered an optimistic outlook based on the fact that the majority of Pennsylvania's forests were young and the growth potential was likely to meet future demands (Ferguson, 1958).

In 1965, ten years following the Northeastern Forest Experimental Station's study, the Pennsylvania's Department of Commerce and the Department of Forests and Waters sponsored a survey and study of Pennsylvania's timber resources designed to evaluate development of new wood industry products and companies. The 1965 study focused on maximizing forest resource outputs and providing an economic boost to the state. The report addressed market trends and recommended wood products that might be attractive to consumers. The report also concluded that there were sufficient water and wood resources, affordable power, fuel to operate mills, an available workforce, an adequate transportation system, and a tax structure that could attract new industrial firms (Department of Commerce, 1965).

Whereas the 1955 study had primarily assessed the content of Pennsylvania's forests, the 1965 report focused on increasing the industry's growth and production levels. Money and big business had always been associated with the lumber industry, but the Pennsylvania Department of Commerce report outlined a "big picture" approach to improving the entire industry and bringing greater wealth to the Commonwealth. Subsequent studies conducted by the Department of Commerce, the US Forest Service, and the Department of Forests and Water during the 1950s, 1960s and 1970s, gave resource managers and the timber industry the ability to make informed decisions to optimize conservation and board foot volume yields. Economists and specialized marketing analysts were now an essential part of the wood products industry. Knowledge of tree planting, growing, and harvesting alone was no longer sufficient; wood industry companies had to successfully research, plan, and market their products to effectively compete in an increasingly complex economy. Today Pennsylvania leads the United States in hardwood species growth and is the second leading producer of sawtimber in the nation. This alone demonstrates the success of the industry during the last four decades (Hardwood Lumber Manufacturer's Association, 1999).

Forest Pests: Gypsy Moth, Bruce Spanworm, and Woolly Adelgid

Forest health monitoring and management is an important component of modern forestry practices. Since the nineteenth century, Pennsylvania's forests have been vulnerable to exotic and invasive pests, such as the gypsy moth and bruce spanworm, that have significantly affected forest composition and health. Some of these are discussed below.

Gypsy Moth

Gypsy moth (*Lymantria dispar*) evolved for thousands of years in Asia and Europe prior to its introduction to North America. Accidentally, in 1868 or 1869, the gypsy moth was introduced to the Boston area and has plagued North American forests, particularly those in the Northeast, ever since (Liebhold, 1998). Gypsy moths destroy the foliage of hundreds of tree species, but are especially specific toward oaks and aspen (DeCoster, 1995; Liebhold, 1998). The moth infestation can devour foliage in massive tree stands with densities fluctuating from one egg mass per year to one thousand per year in any stand (Liebhold, 1998). If large densities of trees are afflicted by gypsy moths, growth is lost and weaker trees are killed. If defoliation occurs over two years or more, tree mortality increases significantly.

By 1890, the state government of Massachusetts and the federal government attempted to eradicate the gypsy moth. However, their methods failed, and the gypsy moth coverage area expanded exponentially (Liebhold, 1998). By 1932, an ambitious gypsy moth management plan was in place for Pennsylvania, New York, and New Jersey, but the difficulty of keeping the insects in specific places hindered the effort. DDT, lead arsenate, and spray programs were initiated, but with environmental consequences, which lead to a ban on DDT in 1963 (DeCoster, 1995).

The Pennsylvania Department of Environmental Resources took over the gypsy moth control programs from the Pennsylvania Department of Agriculture in 1971 (DeCoster, 1995). Forest ecologists and other researchers still cannot explain or predict the pattern of occurrence of gypsy moth populations. Biological agents such as viruses, parasitoids, fungi, and small mammals have been the most popular natural control mechanisms over the past 20 years. Along with this several million acres have been sprayed with biological agents, such as *Bacillus sp.*, or pesticides since the late 1970s (DeCoster, 1995; Liebhold, 1998). Overall, useful controls exist, but gypsy moths continue to plague Pennsylvania's forests.

Bruce Spanworm

Bruce spanworm are bright green caterpillars often seen nibbling at the unfolding leaves of hardwoods of the Northern U.S. during early spring. Only about $\frac{3}{4}$ inch long, the caterpillars are especially fond of feeding on the leaves of sugar maple (*Acer saccharum*), aspen (*Populus sp.*), and beech (*Fagus grandifolia*). Quite often, trees can become completely defoliated where stands of these hardwoods are numerous. After four to five weeks of feeding upon leaves and leaving nothing but leaf veins, the caterpillars fall to the ground to pupate. Bruce spanworm populations generate only once per year.

As with many caterpillars, bruce spanworm can be controlled in a variety of ways, but can in no manner be eradicated. Management strategies include physical, biological, and chemical controls. For example, because females are wingless moths, they need to crawl up trees to lay their eggs. Therefore, temporary physical barriers have been designed to prevent the female bruce spanworm from doing this. "Tree tanglefoot" is spread around the trunk on heavy paper about 15-20 cm wide during the second week in October. Biological controls, such as *Bacillus thuringiensis*, can also be used on the caterpillars without harm to other insects (Forest Health Network [FHN], 1999). However, according to FHN (1999), the most effective control for bruce spanworm is to spray trees with registered insecticides.

Woolly Adelgid

A more recent phenomena in Pennsylvania's forests is the presence of the woolly adelgid (*Aldegeus tsugae*). The woolly adelgid was introduced into the United States from Japan in the 1920s. The insect was first noticed in southeastern Pennsylvania in 1969. Although most of the insect's population has been concentrated in eastern portions of the state, Lycoming County hemlocks have been infected, and the first adelgid case was reported in southwestern Pennsylvania in early 2000. This tiny, soft-bodied insect is closely related to the aphid and feeds on the sap of young hemlock (*Tsuga canadensis*) tree branches. Woolly adelgids encompass hemlock needles with highly recognizable, wispy cotton-like masses on which females lay their eggs. The adelgid's feeding patterns cause premature needle drop and branch dieback, both of which are eventually fatal to the hemlock tree (Hopey, 2000).

Hemlock fatality is perpetuated throughout regional forest stands via rampant adelgid reproduction. When wingless adult females lay eggs in April, the newly-hatched nymphs crawl toward the young branches of the hemlocks, taking up residence at the base of the needles where they feed. Adult females secrete a white, waxy covering onto the tree's needles in June and subsequently lay their eggs within this medium. This covering is what gives the needles a cotton-like appearance.

Aside from wind and bird redistribution of adelgid eggs, the first generation adult adelgid is winged and can readily migrate. This alone fosters rapid infestation of other hemlock trees. In addition, all adelgid adults are female and lay eggs, which further amplifies the proliferation of adelgid infestations (Hopey, 2000).

Forest managers have met numerous stumbling blocks with woolly adelgid eradication. Silviculture control methods have not worked, and populations of the insect are resilient to harsh conditions because all adults are female and populations can rapidly rebuild. Managers are continuing to look at biological controls, such as imported Asian beetles, which feed on woolly adelgids (Hopey, 2000).

Post W.W.II Employment in the Wood Products, Furniture and Paper Industries

Between 1947 and 1956, the Pennsylvania Department of Labor and Industry stated that over 12 percent of Pennsylvanians employed in manufacturing industries were employed in the woods products, furniture, or paper industries. Relative to manufacturing industries across the US, Pennsylvanians made up 2.4 percent of the nation's wood product industry, over 6 percent of the nation's furniture industry, and 7 percent of the paper and pulp industry. During this period, wood product mills were small relative to other industries and were generally not concentrated in any particular region. In 1956, only nine counties counted the wood product industry as a major economic source (Saylor, 1959).

Compared to the 1930s, Pennsylvania's post-World War II forests had recovered enough to become important to statewide economy. Curiously, however, the wood products industry employed fewer and fewer Pennsylvanians between 1945 and 1959, the period of the post-war housing boom. Demands on the furniture and paper industries continued to rise, though possibly indicating specialized demands upon timber types within the greater wood, furniture, and paper industry. Today the timber and forest products industry is Pennsylvania's seventh largest employer, with over 2,500 firms employing approximately 90,000 individuals, an increase of more than 30% since 1975 (Hardwood Lumber Manufacturer's Association, 1999).

Department of Labor and Industry statistics and summaries for each Pennsylvania county and many larger cities and towns are available for future research. The bulk of available information spans the period from 1947 to 1990, making it possible to reconstruct the lumber industry's employment and economic history for all counties within the Lumber Heritage Region for the modern forest management era.

Fluctuations in Supply and Demand

Historically, the lumber industry has seen wide fluctuations in supply and demand. Beginning in the Pioneer Era, seasonal conditions placed constraints on procurement and transportation of logs and finished products. During both the Pioneer and White Pine/Rafting eras, logs were generally and most easily pulled by horses over snow, while twentieth-century log procurement was preferably conducted during dry and warmer conditions, which created a new kind of seasonal fluctuation in the wood supply. A report submitted to the Department of Labor and Industry in 1959 specified that the summer and fall were peak production times for the wood products industry (procurement and mill work), and fall and winter was the peak production period for the manufacturing of furniture, pulp, and paper. In contrast to the wood products and furniture industry, seasonal fluctuations had a much smaller effect on the paper industry (Saylor, 1959).

Not only did seasonal conditions affect the wood product industry, but a wide variety of trends such as wartime economies and population growth placed or removed demands for raw materials and finished products. During the nineteenth century, many logging operations focused on production of lumber or other wood products, which resulted in an over-saturated market and a deflation of value. Shrinking profit margins and sensitivity to a volatile market caused many businesses to close. Between 1920 and 1940, several US western lumber companies began to produce pulp and paper, with less waste and more stable production, since the log procurement during summer and fall neatly complemented the paper production period during late fall and early winter. The trend towards corporate diversification continued into the latter half of the twentieth century with the expansion into a wider variety of wood products and even unrelated resources such as petroleum and chemicals (Sinclair, 1992).

Beginning in the 1960s, industry managers and marketing staff oriented their production towards the perceived needs of the customers. This approach resulted in an unmanageable amount of products and created conflicts between the marketing and manufacturing departments. By the end of the 1970s, this marketing technique had run its course and the industry returned its focus to resource management and production facilities. The 1980s are remembered as a period of weak demand for wood resources and renewed efforts on behalf of the industry to market wood products. In contrast to the 1960s, this period is also characterized by lesser diversification (Sinclair, 1992).

Today's economy tends to favor large manufacturing and retail lumber and wood product companies (Day, 2000). Except for a few manufacturers and retailers of very specialized products, it is generally more difficult for small businesses, especially for small retailers of lumber, to compete with corporations that dominate in regional and national markets. Companies such as International Paper, Weyerhaeuser, Lowe's, and Home Depot are examples of

paper, lumber production, and retail lumber companies that have out-competed locally-owned businesses (Day, 2000). Lessons learned in the last 150 years have helped the lumber and logging industry become more efficient, and have helped large companies protect themselves from the inherently volatile nature of the industry.

Lumber Industry Organizations and Trade Associations

Historically, the interests of some small lumber companies were represented in professional trade associations, which may be one of the reasons that many of the smaller retailers and manufacturers are still in existence. Prior to the 1920s, logging and mill operations were focused on production. To generate increased revenue, a mill would simply cut and mill more timber. In the nineteenth century, during periods of surplus lumber and low demand, logging operations and mills were often faced with the prospect of selling their goods at a greatly reduced price. To avoid price wars and greatly reduced profit margins, lumber operations with similar interests joined forces to protect their rights and ensure a reasonable and stable share of compensation for work or resources. Cooperation, generally in the form of price fixing, brought stability to the industry (Franz, 2000). Toward the end of the nineteenth century, trade associations, already established for other businesses, appeared in the lumber industry representing lumber manufacturers, wholesalers, and retailers (Franz, 1992).

With the advent of systematic, production-level logging operations during the mid-nineteenth century, specialization within the industry rapidly increased. Mills could focus on production and sell their lumber more economically to wholesalers or retailers, rather than directly to consumers. Wholesalers generally purchased large quantities of lumber and, in turn, sold smaller quantities to manufacturing companies or to retailers. Retailers generally sold smaller quantities to smaller businesses, construction companies, and other consumers. Both wholesalers and retailers served to move lumber closer to consumers and provide alternate storage facilities. Within the intricate system of resource procurement, millwork, and distribution, there developed an understanding of ethical conduct versus illegal transactions. Trade associations helped formalize this code of ethics (Franz, 1992).

Currently, trade associations such as the Eastern Building Material Dealers Association (EBMDA) and the Hardwood Lumber Manufacturers Association (HLMA) represent the interests of the lumber industry within Pennsylvania. EBMDA and HLMA, like most trade associations, provide their members with information relevant to their industry, assist with job placement for displaced workers, promote the use of new products, conduct or provide information on marketing, commercial, and industrial research, and lobby for governmental policy and management commensurate with the industry's values and goals (Franz, 1992).

In 1988, the state legislature approved the formation of the Pennsylvania Hardwoods Development Council with representation from the Senate and House of Representatives, lumber industry, value-added industry, forestry, and education. The mission of the Council is to promote the economic development and expansion of Pennsylvania's hardwood industry. Working with state and local governments and other entities, the Council promotes access to the timber resource on both private and public lands; assists the forests products industry in developing domestic and international markets for value-added products; and promotes the development, processing, and manufacturing of value-added forest products. The Council also supports educational programs to enable the public knowledge of the important role that the forest industry and its products play in our society (Bender, 2000).

Small Wood Products and Non-Timber Forest Products

Initial logging efforts were focused on white pine and other valuable sawtimber, but as supplies of the biggest and best trees dwindled, individuals began to use leftover material to make products such as charcoal, acetic acid, kindling, and specialized manufactured items. Long before the turn of the century, there were many uses for wood scraps: wooden toys, wooden containers, clothespins, shingles, barrel staves, and axe handles. However, even wood scraps were carefully selected by quality and suitability for various designated uses. Specialty wood products manufacturers were an historically significant part of the logging industry, but by the second half of the twentieth century, few remained in existence. Some specialty products from companies like the Holgate Toy Company have a lasting fascination, but are a very small component of the overall wood products and lumber industry today (Day, 2000). Seventeen Pennsylvania manufacturers are certified as "chain-of-custody" manufacturers or distributors of certified products such as furniture, toys and musical instruments.

Pennsylvania is also the producer of fine maple syrup and maple sugar products. Native Americans introduced European settlers to the practice of tapping maple sugar trees in the 1600s. Beginning in the early seventeenth and eighteenth centuries, rural settlers used maple sugar as the primary form of sweetener. During the Great Depression of the 1930s, maple sugar was also the main source of sweeteners for rural residents. Pennsylvania is currently the fifth largest producer of maple syrup and maple sugar products, but with only 5% of its maple trees tapped, Pennsylvania has the potential to equal Vermont in maple sugar production. Maple sugar products produced by Tioga County's Patterson Farms, the second largest manufacturer of maple syrup and maple products in Pennsylvania, include maple syrup, jelly, salad dressing, barbeque sauce, candy, and granulated maple brown sugar (Patterson, 2000).

Since the early 1960s, the Bureau of Forestry has given consideration to managing non-timber forest products (NTFPs) such as Christmas trees and boughs, wild mushrooms, blackberries, wreath materials, and other resources generally collected for personal use. Similarly, the Allegheny National Forest issues Special Use Permits for collection of significant amounts of non-timber wood and plant resources on a case by case basis. That both the state and federal governments regulate the collection or use of non-timber forest products emphasizes that these agencies recognize the value of this niche resource.

Environmental Movement: The Laws, Regulations, and their Enforcement

In the 1960s, growing public interest in the management of publicly-owned forests prompted the establishment of the Multiple-Use Sustained Yield Act of 1960, the 1964 Wilderness Act, and the National Environmental Policy Act (NEPA) of 1969. The Multiple-Use Act directed equal consideration for recreation, rangeland, timber, water, and wildlife; the Wilderness Act established tight constraints on activities within areas designated as wilderness; and NEPA created guidelines for assessing any federal action that has the potential to significantly affect the environment. Additional interest in management of federal lands brought about the Renewable Resource Planning Act of 1974 and the National Forest Management Act of 1976, both of which led to the establishment of procedures used by national forests to develop a management strategy or [forest] plan (Richards, 1987).

During the period that generated federal forest management legislation, environmental laws specific to resource types were also enacted. Some of these laws include the Endangered Species Act of 1973, the Clean Water Act of 1987, the National Historic Preservation Act of 1966, and the Archaeological Resources Protection Act of 1979

Many years ago, foresters and the Pennsylvania legislature recognized that the state's most valuable resource was water, and subsequently, most state environmental laws focus on protecting the Delaware, Susquehanna, and Allegheny Watersheds (Day, 2000). As long as the water quality was protected, foresters and legislative officials determined there was no need to enact specific logging laws. In 1995, the Pennsylvania Department of Environmental Resources (formerly the Bureau of Forests and Water) was separated into two departments: the Department of Environmental Protection (DEP), and the Department of Conservation and Natural Resources (DCNR). Most of Pennsylvania's environmental regulations are generated within the DEP in response to legislation that mandates or authorizes their development (Mattoni, 1997). For a project or activity that requires earth-moving activities (i.e., establishment of new logging roads), DEP may require that an individual or company provide a soil erosion and sedimentation control plan. Such a plan would ensure the adherence to Pennsylvania's Clean Streams Law of 1993

(Mattoni, 1997). Regulation and enforcement of the Clean Streams Law is shared between the DCNR Conservation Districts and the Pennsylvania Fish and Boat Commission (Day, 2000).

Pennsylvania State Forest and National Forest Management: 1970 to 1999

In the last three decades, managers of forests on Pennsylvania's state and federal land have been required to abide by various environmental laws. At first, managers frequently had different interpretations of the laws and adherence to any given one was not always uniform between or within state and federal agencies. Prior to the creation of these laws, federal and state land managers, particularly foresters and park rangers, spent the majority of their careers out-of-doors. Many of the environmental laws, especially process-oriented laws such as NEPA required state and federal land management agencies to prepare an increasing number of documents, thus demanding more office-oriented staff.

In response to the state and federal laws, land management agencies began to employ more non-foresters including recreation, wildlife, and cultural resource specialists. Beginning in 1970, the Bureau of Forestry's management plans addressed timber, water, recreation, mineral and wildlife resources (Day, 2000). Originally forest management plans were to be established every 15 years, but the planning interval was decreased to 5 years beginning in the year 2000. In response to the National Forest Management Act (NFMA), the Allegheny National Forest established its current forest plan in 1986, a plan that will also be revised and updated periodically. Currently, the Allegheny National Forest is undergoing a forest plan revision.

State and federal land managers are familiar with the dynamics of land management practices. Concepts and practices in forest and resource management change depending upon the latest understanding of what is required by law. One concept that has withstood the challenge of time, however, is that of sustainable forestry. Since about 1960, the Multiple-Use-Sustained Yield Act has mandated sustainable forestry practices and consideration for outdoor recreation and wildlife habitat (USDA Forest Service, 2000). In 1997, the Bureau of Forestry was certified as practicing sustainable forestry on many state forests, and in 1999, the balance of state forest land was certified by a third party, Scientific Certification Systems, to be sustainable (Day, 2000). Certification will guarantee that Pennsylvanians will have a perpetual supply of forest resources and that non-timber resources will be guarded from mismanagement or permanent loss.

Pennsylvania has more than 2.5 million acres of forests certified as "well managed" under the standards set by the international Forest Stewardship Council (FSC). The state forest system

accounts for 2.2 million of these acres, making it the largest certified forest in North American. Private companies of individuals own the remaining certified forests (DCNR, 2000).

Pennsylvania ranked first in select export species of the 37 eastern states in the hardwood-producing region with 11% of the volume. Pennsylvania also ranked a close second in sawtimber volume of all species. More than 70 species of hardwoods are available in Pennsylvania. The most abundant hardwoods in Pennsylvania include the Northern red oak (16.1%), white oak (15.5%), red maple (13.6%), and black cherry (10.0%). Other Pennsylvania hardwoods include hard maple, other oaks, beech, poplar, ash, and hickory.

Pennsylvania is a leading supplier of export-grade hardwood lumber and forest products with exports totaling \$796 million. The United Kingdom is the second leading importer of Pennsylvania hardwood, behind Canada, importing \$43.1 million in 1999. Canada imported \$430.3 million in 1999.

A Brief History of Recreation in Pennsylvania's State and National Forests

Socioeconomic changes during the twentieth century substantially changed patterns of outdoor recreation on public land. This in turn influenced land management policies and practices. Prior to the 1900s, leisure time was a luxury reserved mostly for the upper class. "During the early 1900s, increased attention focused on the need for park and recreation services for the general population. Increased crowding in urban areas, a moderate reduction in the Protestant work ethic, a growing economy, and an improving transportation system were some of the factors that led to the need to address the leisure and recreational needs of the lower and middle classes. During the early 1900s, the number of parks, playgrounds, and agencies such as YMCAs were established to meet these needs. At the same time, these services were 'professionalized' with the establishment of the Playground Association of American (1906), which later evolved into the National Park and Recreation Association (1966). Subsequent events during the twentieth century such as the Great Depression and World War II prompted abrupt changes in levels of recreation demand and service provision" (Caldwell, 2000).

One nationwide consequence of the Great Depression was that little money was available for non-essential purposes, bringing a sudden change in recreation patterns across America. Precious leisure time was spent in closer proximity to home and on activities that required little expense such as outdoor recreation on state and national forests. Additionally, recreation sites established by the CCC and WPA during the 1930s provided wider opportunities for camping, hiking, and swimming.

It was not until the period following World War II that an improved nationwide economy set the stage for further increases in leisure time and recreation. In response to a rapidly growing population, the Eisenhower Administration designed an interstate highway system to meet the transportation needs of the American people, dramatically affecting recreation in Pennsylvania's state parks and forests, as well as in the Allegheny National Forest. During the 1930s and 1940s, for example, the Allegheny National Forest promoted recreation by permitting privately-owned cabins on federal land. The establishment of Interstate 80 and other state highways, however, essentially eliminated the need to encourage people to visit the forest. Prior to the existence of I-80, travel to state forests and parks was considerably more arduous, and visitors usually stayed for two weeks. The establishment of I-80 and the improved motorized campers and trailers of the 1960s and 1970s brought weekend-oriented campers. The state parks and forests began to experience bursts of activity on weekends and weekday periods with few visitors. They began to feel the effects of additional visitors and responded by quickly improving roads and facilities to meet the new demands (Day, 2000).

In the early 1960s, the federal government recognized a need to address a "recreation crisis." In response, the Bureau of Outdoor Recreation was established. The newly formed agency created the Outdoor Recreation Resource Review Commission in 1962, which subsequently designed a comprehensive plan to address recreation issues. The Outdoor Recreation Resource Review Commission required states to create a State Comprehensive Outdoor Recreation Plan (SCORP). In return, the states received federal funding from the Land and Water Conservation Fund. During the same period, interest in recreation planning efforts prompted legislative measures such as the Wild and Scenic Rivers and the National Trail Acts. In 1985, during the Reagan administration, the President's Commission on American's Outdoors was created. As part of this program, the US Forest Service collected information on recreation in national forests (Caldwell, 2000).

The expanded recreational use of state and federal forest land affected logging practices by limiting or modifying tree harvesting in close proximity to areas with considerable recreational use. On federal land, the expertise of landscape architects and other resource specialists is used to address visual effects of removing vegetation. Agency managers routinely address the effects of logging activities on local roads and communities. State and federal land managers also address the potential a proposed activity has to adversely affect the quality of recreational experiences such as hiking scenic trails, or fishing and boating in reservoirs. Pennsylvania's state parks, and forests and the Allegheny National Forest continue to be popular public recreation areas. In 1999, some Pennsylvania state parks had over 1 million visitors (Day, 2000). The Forest Service measures recreation in national forests by "recreation visitor days". One recreation visitor day is equal to 1 person spending 12 hours recreating in the forest. The Allegheny National Forest estimated that in 1997 there were 3,300,000 recreation visitors to the

forest (USDA Forest Service, 1999). In 1999, the Allegheny National Forest led northeastern national forests with over 3, 907,000 recreation visitor days (Lemery, 2000). The large increase in visitors to Pennsylvania's parks and forests is one of the most important reasons that state and federal management of these lands has become so complex.

State and Private Forestry: A United States Department of Agriculture Public Service

With 96 percent of Pennsylvania's forests located on non-federal land, the US Forest Service identified a need to provide services to state and private owners that would benefit the overall health of these forests. The State and Private Forestry (S&PF) branch of the US Forest Service works to assist state, county, and municipal entities, as well as private land owners with forest-related issues. S&PF also provides "technology transfer" by disseminating the latest information on technology in the field of forestry and logging. S&PF organizes and publicizes continuing education courses on forestry practices and monitors programs such as planting and fencing programs for which federal funding is allocated. It also provides the framework for wildlands firefighting operations, working with states to control and prevent fires and helping rural communities procure firefighting equipment. In 1990, S&PF instituted a national forest health monitoring program to monitor, assess and report on the status, changes and long term trends on the health of the nation's forests" (Burd, 2000).

Public Involvement and Partnerships

In recent years, the Pennsylvania Bureau of Forestry and the US Forest Service have improved their public outreach and public affairs programs. The Bureau of Forestry actively solicits input by holding public meetings in urban and rural locations. The DCNR accepts e-mail and anonymous responses directly from their Internet home page. DCNR and the Bureau of Forestry also maintain an open dialog with a variety of special interest groups, including various environmental organizations (Day, 2000). Managers of the Allegheny National Forest hold public meetings to discuss controversial issues, and routinely accept and respond to comments from individuals and organizations regarding proposed projects.

To operate more efficiently and to make the most of limited budget allocations, the Bureau of Forestry and the US Forest Service often form partnerships with public and private entities that have parallel or similar goals. DCNR has formed partnerships with organizations like Trout Unlimited, the Appalachian Trail Council, and the Western Pennsylvania Conservancy.

Similarly, the Allegheny National Forest has partnerships with local universities, the National Wild Turkey Federation, and local fire departments.

Modern Forest Management Era Property Types

Property types associated with the modern forest management era are resources such as privately owned sawmills, and the state and federal administrative offices and facilities used for the management of forest lands. Except for mills and offices constructed in the first few years following World War II, these resources are generally less than 50 years old and are not considered to be historic. Forests often contain hints of previous logging activity and land use such as plantations, temporary roads and skid trails, forest fire evidence, stands of old growth forest, apple trees planted for wildlife, thick stands of small trees, and clearings. These features are cultural landscapes that demonstrate the intense management of Pennsylvania's forest lands during the last fifty years.

*Lumber Heritage Region
Historic Context Bibliography*

Published References:

- Agnagnostakis, S.L. (1996). The Chestnut Story. The Woodworking Times, Issue 2.
At: www.woodworking.com/magazine/mar96/chestnut/cnut5.html
- Akeley, A. (1979). Story of the white pine. Potter County Historical Society Quarterly Bulletin No. 51, January 1979 Coudersport, Pennsylvania.
- Beebe, V. L. (1939). A history of Potter County, Pennsylvania. Potter County Historical Society, Press of Potter County Journal.
- Bureau of State Parks (n.d.). Recreational guide for Bendigo State Park. Department of Environmental Resources, Commonwealth of Pennsylvania.
- Bureau of State Parks (1992). Recreational guide for Black Moshannon State Park. Department of Environmental Resources, Commonwealth of Pennsylvania. DER#117-11/92.
- Bureau of State Parks (n.d.) Recreational guide for Parker Dam State Park. Department of Environmental Resources, Commonwealth of Pennsylvania.
- Cantelon, P. L. and K. D. Durr (1996). The Roadway story. Montrose Press, Rockville, Maryland.
- Casler, W. C. (1973) Tionesta Valley. Book No. 8 in the Logging Railroad Era of Lumbering in Pennsylvania Series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Casler, W. C. (1977). Allegheny valley logging railroads. Book No. 11 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Cohen, S. (1980). The tree army. A pictorial guide of the Civilian Conservation Corps, 1933-1942. Pictorial Histories Publishing Co., Inc., Missoula, Montana.
- Colcord, M. (1979). Rafting days on the Sinnemahoning. Potter County Historical Society Quarterly Bulletin No. 52, Coudersport, Pennsylvania.
- Colcord, M.J. (1995). Bubbles on water good sign of rafting time. Potter County Historical Society Quarterly Bulletin No. 116, April 1995, Coudersport, Pennsylvania.
- Cook, A.E. (1997). The Cook Forest an island in time. Falcon Press Publishing Company, Helena, MT.

- DeCoster, L. A. (1995). 1895-1995 The legacy of Penn's woods. A history of the Pennsylvania Bureau of Forestry. Harrisburg, PA: Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission for the Department of Conservation and Natural Resources Bureau of Forestry 1995.
- Department of Commerce (1965). Location Guide for Forest-Based Industries in Pennsylvania Commonwealth of Pennsylvania, Harrisburg, Pennsylvania.
- Evanetski, J.R. (n.d.) Our time in history: celebration of Warren's centennial. Warren County Guide, Warren, Pennsylvania.
- Ferguson, R. H. (1958). The timber resources of Pennsylvania. Northeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Upper Darby, Pennsylvania.
- Fischer, D. H. (1996) The great wave. Price revolutions and the rhythm of history. Oxford University Press, Inc., New York, New York.
- Flink, J. J. (1975). The car culture. Massachusetts Institute of Technology Press, Cambridge, Massachusetts.
- Forest Health Network (FHN). 1999. Bruce Spanworm.
At: http://www.fcmr.forestry.ca/fhn/info/fp1/Bruce%20Spanworm_e.html
- Franz, G. W. (1992). Eastern Building Material Dealers Association. A centennial history. The Donning Company/Publishers, Virginia Beach, Virginia
- Groenendaal, D, & T. E. Jones (1998). Lumber Heritage Region feasibility study. Submitted to the Lumber Heritage Region Steering Committee and the North Central Pennsylvania Regional Planning and Development Commission, Ridgway, Pennsylvania.
- Grumet, R. S. (1995). Historic contact Indian people and colonists in today's northeastern United States in the sixteenth through eighteenth centuries. University of Oklahoma Press, Norman and London.
- Huntley, G. W. (1936). A Story of the Sinnamahone. Williamsport Printing and Binding Company, Williamsport, Pennsylvania.
- Journal of Lycoming County (1984). Volume 20, No. 2.
- Katovich, S. and Mielke, M. 1998. How to Manage Eastern White Pine to Minimize Damage from Blister Ruse and White Pine Weevil. NE-FR-01-93. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.
At: http://willow.ncfes.umn.edu/ht_white/white.htm#recs.

- Kennedy, D. M. (1999). Freedom from fear. The American people in depression and war, 1929-1945. Oxford University Press, Inc., New York, New York.
- Klein, P. S. & A. Hoogenboom (1980). A history of Pennsylvania. Second ed., Pennsylvania State University Press, University Park, Pennsylvania
- Kline, B. F.G. Jr. (1971). Pitch pine and prop timber. Book No. 1 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Kline, B. F.G. Jr. (1975). Dinkies, dikes and sawdust. Book No. 12 in the Logging Railroad Era of Lumbering In Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Kosack, J. (1995). The Pennsylvania Game Commission 1895-1995. Pennsylvania Game Commission, Harrisburg, Pennsylvania.
- Kraybill, S. L. (1991). Pennsylvania's Pine Creek Valley and pioneer families. Gateway Press, Baltimore.
- Leeson, M. A. (1890). History of the Counties of McKean, Elk, Cameron, and Potter, Pennsylvania. Chicago: T.H. Beers and Co.
- Liebold, S. 1998. Gypsy Moth in North America. U.S. Department of Agriculture, Forest Service, Northeastern Research Station, Forest Sciences lab.
At: <http://gypsy.fsl.wvnet.edu/gmoth/home.html>.
- Linn, J.B. (1883). History of Centre and Clinton Counties, Pennsylvania. Centre County Historical Society. J.B. Lippincott and Co., Philadelphia.
- Marquis, D. A. (1975). The Allegheny hardwood forests of Pennsylvania. USDA Forest Service general technical report NE-15. Forest Service, U.S. Department of Agriculture Northeastern Forest Experiment Station, Broomall, Pennsylvania.
- Mattoni, J., R. W. Weidner, S. J. Schwartz, K. Treadway & J. E. Minihan (1997). Pennsylvania environmental law handbook. Fifth ed. Government Institutes, Inc., Rockville, Maryland.
- McWilliams, W.H., White, Arner, S.L., Nowak, C.A., Stout, S.L. N.d. Characteristics of Declining Forest Stands on the Allegheny National Forest. Research Note NE-360. U.S. Department of Agriculture, Forest Service, Northeastern forest Experiment Station. pp. 9.
- Meginness, J.F. (1889). Otzinachson: a history of the West Branch Valley of the Susquehanna. 1991 reprint, Gateway Press, Baltimore.
- Odum, E.P. 1983. Basic ecology. Philadelphia: Sanders College Publishing, pp. 613.

- Painter, F. H. (1939). A picture of Lycoming County. the commissioners of Lycoming County, Pennsylvania.
- Partridge, R. (1958). Tannery times good and bad. Potter County Historical Society Quarterly Bulletin. No. 60, April 1981, Coudersport, Pennsylvania.
- Pennsylvania Railroad (1891). Ceremonies upon the completion of the monument erected by the Pennsylvania Railroad Company at Bordentown, New Jersey. Published for the Pennsylvania Railroad Co. by Gedney and Roberts, Washington, D.C.
- Pyne, St. J. (1982). Fire in America. A cultural history of wildland and rural fire. Princeton University Press, Princeton, New Jersey.
- Richards, E.G. (1987) Forestry and the forest industries: past and future. Prepared to mark the fortieth anniversary of the establishment of the Timber Committee of the United Nations Economic Commission for Europe (ECE) and the European Forestry Commission of the Food and Agriculture Organization of the United Nations (FAO). Martinus Nijhoff Publishers, Boston.
- Robbins, W. G. (1982). Lumberjacks and legislators. Political economy of the U.S. lumber industry, 1890-1941. Texas A&M University Press, College Station.
- Ross, P. W. (1996). Allegheny oil. The historic petroleum industry on the Allegheny National Forest. Prepared for the Allegheny National Forest in partnership with the Institute for the History of Technology and Industrial Archaeology, West Virginia University, Eberly College of Arts and Sciences. USDA Forest Service Eastern Region, Allegheny National Forest Heritage Publication No. 1.
- Saylor, R. B. (1959) Employment in Pennsylvania since World War II. Prepared for the Department of Labor and Industry of the Commonwealth of Pennsylvania. Bureau of Business Research, College of Business Administration, Pennsylvania State University.
- Shank, P.E. (1973). The amazing Pennsylvania canals. American Canal & Transportation Center, York, Pennsylvania.
- Shank, P.E. (1988). Indian trails to super highways. American Canal & Transportation Center, York, Pennsylvania.
- Sharp, M. B. & W. H. Thomas (1965). A guide to the old stone blast furnaces in western Pennsylvania. The Western Pennsylvania Historical Magazine. Vol. 48, No. 1, January 1965.
- Sipe, C. H. (1931). The Indian wars of Pennsylvania. 1995 reprint, Wennawoods Publishing, Lewisburg, Pennsylvania.
- Schenk, T.S. (1887). History of Warren County, Pennsylvania. D. mason and Co., Syracuse.

- Scott, K.M. (1888). History of Jefferson County, Pennsylvania. D. Mason & Co., Syracuse.
- Simmons, R. E., United States Forest Service (1914). Wood-using industries of Pennsylvania. Department of Forestry, Commonwealth of Pennsylvania Bulletin No. 9. April, 1914. Wm. Stanley Ray, State Printer, Harrisburg, Pennsylvania.
- Sinclair, S. A. (1992) Forest products marketing. Magraw-Hill Series in Forest Resources. Magraw-Hill, Inc., New York.
- Sproul State Forest (2000). Prowling the Sproul. Vol. 2, Issue 1. DCNR Bureau of Forestry, Commonwealth of Pennsylvania.
- Steel Industry Heritage Corporation (n.d.). Rivers of steel. Steel Industry Heritage Corporation Executive Summary. SIHC, Homestead, Pennsylvania.
- Taber, T. T., III (1971). The Goodyears an empire in the hemlocks. Book No. 5 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Taber, T. T., III (1972a). Muncy Valley lifeline. The life and times of the Williamsport and North Branch and Eagles Mere Railroads. Printed by Reed Hann Litho.
- Taber, T. T., III (1972b). Sunset along Susquehanna waters. Book No. 4 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Taber, T. T. III (1972c). Whining saws and squealing flanges. Book No. 6 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Taber, T. T. III (1974). Tanbark, alcohol, and lumber. Book No. 10 in the Logging Railroad Era of Lumbering in Pennsylvania. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Taber, T. T. III (1975). Sawmills among the derricks. Book No. 7 in the Logging Railroad Era of Lumbering in Pennsylvania series. Lycoming Printing Company, Inc., Williamsport, Pennsylvania.
- Tonkin, J. D. (1940). The last raft. Published by the author at Telegraph Press, Harrisburg, Pennsylvania.
- Tonkin, J.D. (1958). My partner the river. University of Pittsburgh Press.
- Wall, T.L. (1925). Clearfield County Pennsylvania present and past. School edition. Published by the author.

Watkins, T. H. (1993). The Great Depression. Little, Brown and Company, Boston, Massachusetts.

Wessman, A. L. (1981). A history of Elk County. Elk County Historical Society, Ridgway, Pennsylvania. Printed By Nupp Printing Company, Sykesville, Pennsylvania and Ridgway Publishing Company, Ridgway, Pennsylvania.

Unpublished References:

Agnagnostakis, S.L. 1996. The Chestnut Story. The woodworking times, Issue 2. [Internet]. www.woodworking.com/magazine/mar96/chestnut/cnut5.html

Anonymous (n.d.). The life and times of Franklin Delano Roosevelt [Internet]. <http://nscds.pvt.k12.il.us/nscds/us/apushist/roosevelt/time.html> (Accessed 3/06/2000).

Bender, D. Wayne (2000). 8/14/2000 letter to Rob Hilliard including a supplemental paragraph about the Pennsylvania Hardwoods Development Council.

CEPI (n.d.). Confederation of European Paper Industries [Internet]. <http://www.paperonline.org/history> (Accessed 3/16/2000).

Forest Health Network (FHN). (1999). Bruce spanworm. [Internet]. http://www.fcmr.forestry.ca/fhn/info/fp1/Bruce%20Spanworm_e.html

Gable, Dr. J. A. (1992). Timeline of Theodore Roosevelt's Life. [Internet]. From the Roosevelt Association at <http://www.theodoreroosevelt.org/life/timeline.htm> (Accessed 3/06/2000).

Katovich, S. and Mielke, M. 1998. How to manage eastern white pine to minimize damage from blister ruse and white pine weevil. NE-FR-01-93. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. [Internet]. http://willow.ncfes.umn.edu/ht_white/white.htm#recs.

Knotts, S. (1995). Wood distillation- a chemical industry. [Internet]. http://getnet.com/~dickg/nmra/sigs/RR_industries/Industry-Lineside.html (Accessed 6/12/2000).

Liebhold, S. 1998. Gypsy moth in north america. U.S. Department of Agriculture, Forest Service, Northeastern Research Station, Forest Sciences lab. [Internet]. <http://gypsy.fsl.wvnet.edu/gmoth/home.html>.

McLaughlin, H.C. (n.d). A matter of history - pulp and papermaking - Lock Haven plant - of Hammermill Papers Group - 1880-1980. A summary of paper making in Lock Haven and Johnsonburg, on file in the Clinton County Historical Society Museum files, Lock Haven, Pennsylvania.

McNeal, Patricia and Doug (2000). 8/2/2000 letter to Rob Hilliard regarding comments to draft historic contexts.

Roosevelt, T. (n.d.). Theodore Roosevelt: A brief biography by Tweed Roosevelt. [Internet]. <http://www.theodoreroosevelt.org/life/biotr.htm> (Accessed 3/06/2000).

Schultz, Dr. S. K. (n.d.). Lecture 21, American History 102: World War II, the home front [Internet]. <http://us.history.wisc.edu/hist102/lectures/lecture21.html> (Accessed 3/14/2000).

United States Forest Service Region 1 (n.d.) National Museum of Forest History (online). [Internet]. <http://www.nfs-museum.org> (Accessed 3/06/2000).

United States Forest Service (n.d.). United States Forest Service. [Internet]. <http://www.ceap.wcu.edu/Houghton/M...ing96/lamp/robinproject3/usfs.html> (Accessed 3/06/2000).

United States Forest Service (2000). An introduction to the Allegheny National Forest. [Internet]. <http://www.fs.fed.us/r9/allegheny/intro.html> (Accessed 3/8/2000).

Unpublished Government Agency Report, Documents, and Contracts

Dyer, L. A. (1999). Cultural resource survey for the Beaver Meadows draw down project. CRR No. 09-19-02-277. USDA Forest Service, Allegheny National Forest, Warren, Pennsylvania.

Frank, K. (1998). ANF timeline of important events. USDA Allegheny National Forest Document, Warren, Pennsylvania.

Frank, O.L. (1978). The bicentennial raft and the rafting era in Pennsylvania. Pennsylvania Bureau of Forestry, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania.

Frank, O.L. (n.d.). History of timber rafting and the settlement, log drives, and rafting points on the West Branch of the Susquehanna River. Pennsylvania Bureau of Forestry, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania.

Ross, P. W. (n.d.). Allegheny lumber heritage: The historic wood products industry on the Allegheny National Forest. Unpublished Manuscript on file with the Allegheny National Forest, Warren, Pennsylvania.

Wolyneec, R. (1978) Cultural resource overview of the Allegheny National Forest, Warren, Elk, Forest and McKean Counties, Pennsylvania. Contract No. 01-3191 Prepared for the USDA Forest Service Eastern Region, Milwaukee, Wisconsin.

Personal Communication with Individuals

- Burket, E. R (1998). Interview with Mr. Edward Burket, former resident of a conscientious objector camp located at Duhring Camp 1 near Pigeon, Pennsylvania. Interview conducted by District Archaeologist Leslie Dyer at the Marienville Ranger District Office in Marienville, Pennsylvania.
- Brooks, W. III (2000). Interview with Mr. William Brooks, owner of Brooks Lumber in Ralston, Pennsylvania. Interview conducted by Leslie Dyer by phone in February and in person in Ridgway, Pennsylvania in March.
- Burd, Carol (2000). Telephone interview with Carol Burd, Supervisory Forester, Allegheny National Forest, Marienville, Pennsylvania. Interview conducted by Leslie Dyer on April 25, 2000.
- Caldwell, Dr. L. (2000). Telephone interview with Dr. Caldwell, professor at the Hotel, Restaurant, and Recreation Management School, Pennsylvania State University, University Park, Pennsylvania. Interview conducted by Leslie Dyer on May 2, 2000.
- Davies, B. (2000). Telephone interview with Butch Davies, Manager at Sproul State Forest. Interview conducted by Leslie Dyer on January 28, 2000.
- Day, A. (2000). Telephone interview with Pennsylvania State Bureau of Forestry Nursery Manager Alex Day. Interviews conducted by Leslie Dyer on January 23 and April 24 and 25, 2000.
- Frank, O.L.. (2000). Interview with former Pennsylvania Bureau of Forestry Forester O. Lynn Frank. Interview conducted by Leslie Dyer on February 11, 2000 in Clearfield, Pennsylvania.
- Franz, G. W. (2000). Phone Interview with the author of Eastern Building Material Dealers Association. A centennial history. Interview conducted on March 29, 2000 by Leslie Dyer.
- Gasparine, J. (2000). Fax letter from Little Pine and Hyner Run State Parks Manager John Gasparine. February 1, 2000 fax from Department of Conservation and Natural Resources Bureau of State Parks containing information on historical and cultural resources located in Little Pine and Hyner Run State Parks.
- Kelley, S. (2000). Telephone conversation with Centre County Historical Society staff member. Phone conversation between Leslie Dyer and Sara Kelley on May 9, 2000.
- Nelson, J. (2000). Interview with Jim Nelson, former Pennsylvania Bureau of Forestry State Forester. Conducted by Leslie Dyer on March 8, 2000 at Ridgway Pennsylvania.
- Nocera, A. (1997). Interview with Angelo Nocera, President of Chapter 125 of Civilian Conservation Corps from NewCastle, Pennsylvania. Interview conducted by Leslie Dyer at Bowman's Mills CCC Camp 7 near Kane, Pennsylvania.

- Norris, P. (2000). Communication with Lycoming County Historical Society curator. Personal communication between Ms. Norris and Leslie Dyer in Williamsport, Pennsylvania on February 4, 2000.
- Patterson, R. (2000). Telephone interview with Richard Patterson of Patterson Farms in Tioga County. Phone conversation between Leslie Dyer and Richard Patterson on October 2, 2000.
- Ross, P. W. (1997). Communication with Allegheny National Forest Historian. Personal communication with Leslie Dyer regarding the significance of logging railroads in Pennsylvania in April 1997.
- Schultz, M. (1998). Telephone conversation with historian Michael Schultz regarding CCC history on the Allegheny National Forest CCC Camp 1. Conversation took place between Leslie Dyer and Michael Schultz during the summer of 1998.
- Schultz, M. (2000). Telephone conversation with historian Michael Schultz regarding CCC fire fighting history. Conversation took place between Leslie Dyer and Michael Schultz on September 26, 2000.