Archaeological Perspectives of the Lumber Industry in Northern Lower Michigan, 1865-1920

Rebecca Ellen Dinsmore

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ARCHEOLOGICAL PERSPECTIVES OF THE LUMBER INDUSTRY
IN NORTHERN LOWER MICHIGAN, 1865-1920

by

Rebecca Ellen Dinsmore

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Anthropology

Western Michigan University
Kalamazoo, Michigan
April 1985
In an attempt to generate predictive statements about site structure and location, the nature of lumber industry development is examined through historical and environmental relationships between logging sites, early logging methods, transportation technology, and the presettlement forest as reconstructed from the original General Land Office surveyor field notes and plats. Eighteen historic logging sites recorded on the Huron National Forest and within the Au Sable River watershed comprise the data set. The purpose of this study is two-fold: (a) to reconstruct the lumber industry history along the Au Sable River, and (b) to develop a means of locating, identifying, and assessing the physical remains of logging activities. Analytical results suggest that logging site distribution may be correlated with technological developments and historical trends in timber demand. By presenting a more timely picture of the vast forests the nineteenth-century lumbermen knew, presettlement forest reconstructions may be invaluable to future archaeological studies of the lumber industry.
ACKNOWLEDGEMENTS

The scope of this study has emerged circuitously from methodological challenges inherent to conducting cost-effective archaeological surveys in dense forests. A number of individuals has contributed to the final product. For introducing me to the problem while I worked as an archaeological technician on the Huron-Manistee National Forests, I must first thank Janet G. Brashler, Ph.D., then Forest Archaeologist. John R. Davis, the current Forest Archaeologist, and I have since spent many hours discussing this project. I am pleased to have had the opportunity to meet with Robert A. Reames and Charles O. Lilley on the Harrisville District, whose knowledge of the Huron National Forest and the lumber industry continually refreshed my ideas.

Within the Department of Anthropology at Western Michigan University, I wish to thank Dr. Robert Jack Smith, Chairman; Dr. William M. Cremin, my major advisor; Dr. Elizabeth B. Garland; and Dr. Robert I. Sundick for presenting to me the broader theoretical and methodological frameworks. I also thank The Graduate College for awarding me a grant from the Graduate Student Research Fund which enabled me to assemble historical data from several archival locations across northern Lower Michigan.

I am most grateful to my friends and associates with whom I have discussed this topic at great length. Thanks to Fel V. Brunett for his continual support and for generously lending me original copies.
of Scribner's Monthly and the Saginaw Daily Courier; and to John G. Franzen, Forest Archaeologist on the Hiawatha National Forest, for sharing a number of cultural resource management reports. My special regards are given to Caven P. Clark, Susan S. Branstner, and particularly to Dean L. Anderson, all of Michigan State University, for their support and constructive deliberation. Dean Anderson and John Davis have also taken time out to read and comment on earlier drafts.

Finally, I thank my parents, Jack and Elizabeth, for helping me to complete this endeavor, and my mother especially, for painstakingly typing and proofreading the early drafts. While acknowledging the invaluable participation of each person, I alone am responsible for the final presentation.

Rebecca Ellen Dinsmore
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I remember on January 19th, 1887, a tramp I had from Wig Creek, on the head waters of the Au Sable River... I did not mind the cold so much, but rather dreaded the journey of eighteen miles, six of which were across the 'plains,' divested of even a jack pine, and with only the woods in the distant horizon to guide me.

John W. Fitzmaurice,

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CHAPTER I  

INTRODUCTION

Problem Statement

Lower Michigan's early lumber industry, from its inception around 1840 through its heyday and decline before 1920, bequeathed to its people a legacy in land and history that has never been equaled. The race to meet the lumber demands of burgeoning eastern and midwestern cities, coupled with the lenient land management practices of post-Civil War government, spawned the exploitation and inevitable destruction of Michigan's virgin forests. As the last stand of prime timber in one area fell under the axe and saw, the industry moved upriver into the next watershed or the next state. Some newly established settlements surviving in its wake stabilized as local trade centers, mill towns, or agricultural communities. Many others did not. These physical legacies, homesteads, schools, and cemeteries, along with countless numbers of abandoned sawmills, railroad grades, tote roads, and lumber camps remained and are now mostly buried under second and third growth timber. Also, in the aftermath, many cutover lands too poor to farm were abandoned and reverted to the public domain. Best suited for timber management and recreation, these lands now comprise much of the national and state forest acreage in Michigan. On public forest lands in northeastern Lower Michigan, logging camps may outnumber all other historical sites.
Recognizing a need to inventory archaeological resources, the former Heritage Conservation and Recreation Service (HCRS) of the U. S. Department of Interior required each state to assess its site files and outline future survey strategies. From this review the State Archaeologist in Michigan has identified a need for more adequate archaeological surveys and research in the northern two-thirds of the state. While USDA Forest Service surveys have added hundreds of historic homesteads, mining camps, and lumber camps to the state files, little excavation or further evaluation of these sites has been undertaken either to establish National Register eligibility or to develop predictive models (Mead 1980:20).

Federal agencies assigned the responsibility of inventorying, evaluating, and managing historical sites face unique problems. Foremost is the sometimes bitter fact that economic constraints frequently prohibit traditional archaeological field study and excavation. Costs of complete pedestrian survey, or 100% coverage, have demanded sampling strategies and greater reliance on archival sources, aerial photograph reconnaissance, local informants, and minimally trained personnel (Brashler and Davis 1980; Commonwealth Associates, Inc. 1982; Franzen and Dinsmore 1983; Mid-America Research Center 1984).

Any single alternative to complete survey results in partial site recovery at best. Archaeological sites not recorded are under constant threat from machinery impact, road construction, and timber sales. Further, with each passing year, the dense surrounding forest
encroaches on the old site clearings, crossing the narrow tote roads, and nearly obliterating site features and context. On some of the early logging sites diagnostic surface artifacts are meager or even absent as a result of both natural and human impacts. Subsequent problems in site dating and evaluation compound the existing difficulties in developing cost effective surveys.

Research Objectives

Ideally, an optimal survey strategy would utilize all existing data recovery methods, some of which provide sole access to certain types of information, e.g., tax records and knowledgeable informants. However, this study proposes to alleviate difficulties associated with the most labor intensive method, the complete pedestrian survey, by developing a model for locating logging camps and other lumber industry sites without recourse to extensive traditional field methods.

Exploring this alternative entails a reconstruction of the relationships between the lumber industry, specifically logging activities, and the changing nature of the timber supply during the industry's most energetic period from about 1865 to 1920. A study area has been selected along a portion of the Au Sable River watershed in northeastern Lower Michigan (See Figure 1). Noted for its rich logging history, the Au Sable River falls largely within the Huron National Forest boundaries. Recent archaeological surveys on this forest land have located the remains of over fifty logging camps.
and homesteads, most of which are still unevaluated. Eighteen sites situated within the contiguous study area shown in Figure 1 provide a small sample of lumber industry sites on the Huron National Forest and in northeastern Lower Michigan.
Figure 1. The Au Sable River basin study area in northeastern Lower Michigan.
CHAPTER II

RESEARCH FOCUS

Previous Research

In an early assessment of lumber industry archaeology, Harris, Price, and Price (1977) support the integration of social and economic history and cultural geography within archaeological research strategies as a means of more fully developing the anthropological potential of an area's cultural history. Citing a need for more research, these authors propose a study of "the settlement plans of logging camps and towns and the relative use of space in each" and an analysis of "the procession of lumber extraction" (Harris, Price and Price 1977:400).

Research questions pertaining to the early lumber industry have only recently been addressed by archaeologists in the Great Lakes region. Most of these are short discussions incorporated within the limited distribution cultural resource planning reports which have been sponsored by the USDA Forest Service, Eastern Region.

The earliest of these reports, primarily archival in nature, compiles all previously documented historic and prehistoric cultural resources within or near the national forest boundaries from Forest Service files, the state site file, land records, and historic maps and atlases. Locational data, site type, and site densities are then compared with environmental data, e.g., water resources and vegetation, to develop generalized predictive statements.
Accompanying these statements are planning maps which depict stratified zones of cultural resource sensitivity. Even though these sensitivity maps have since proven to be too generalized for practical use, the forest-wide overview studies do present a set of initial guidelines designed to enable the disposition and ongoing management of all cultural resources, including lumber industry-related archaeological sites.

In *A Cultural Research Overview of the Huron-Manistee National Forests*, Lovis, Langhome, and Van Arsdale (1978:98-99) have recorded 31 historic period sites for the Huron National Forest. None of these is documented as a logging camp, five are mill locations, one is described as a "railway related" site, one is a "commercial" site, and three are of unknown historic origin. Of the remaining 21 sites, 15 are schools, four are cemeteries, and two are post offices. Such sparse archival findings for historic sites in general preclude any logging site analysis. However Lovis, et al. (1978:91-92) note the significance of the lumber industry in regional and local history and the archaeological importance of logging sites. The underrepresentation of logging sites in the documentary data is thought to result from infrequent recording and the low field visibility of such sites once abandoned.

Subsequent cultural resource surveys on the Huron-Manistee National Forests were conducted from 1979 through 1983. Although in 1979 archaeological crews from Grand Valley State Colleges failed to record any logging sites (Flanders, Barnhill-Booher, Lowery, Prahl,
and Tucker 1979), Forest Service surveys in 1980 and 1981, conducted in-house by professional archaeologists, located some 15 lumber industry-related sites. It should be noted that Forest Service cultural resource surveys entail project-oriented research mandated by Executive Order 11593, the Code of Federal Regulations, and National Environmental Policy Act (NEPA) legislation. Federal agencies are required to inventory lands prior to impact from landscape altering projects such as timber sales, road construction, plantings, and recreational development (Brashler and Davis 1980:1). While locational data collected during these surveys constitute a nonrandom sample, patterns have become evident with the inclusion of additional sites in the roster.

Recent archaeological surveys on the Hiawatha and Ottawa National Forests in Michigan's Upper Peninsula have developed a logging site sample of suitable size to permit preliminary locational analysis. Commonwealth Associates, Inc. (CAI 1982) propose a simplified model of logging camp location for the Hiawatha National Forest which incorporates a comparative analysis of several environmental variables and site data from 31 logging camps recorded during 1980 and 1981 contract surveys (CAI 1982:142). A similar locational analysis has been undertaken for logging sites recovered on the Ottawa National Forest during in-house cultural resource surveys in 1982. The results of these preliminary comparisons suggest that associations with major transportation features and
ecological variables may be indicative of site function and relative age (Franzen and Dinsmore 1983:113-114).

In 1983, contract cultural resource surveys on the Hiawatha National Forest enabled Commonwealth Associates, Inc., to expand and refine the lumber industry model first outlined in 1982. Based on the original expectations that the earliest logging camps would be located along major river systems, the updated model incorporates the location of timber supply and the minimization of transportation efforts to develop a stronger ecological theme. Measurable data extracted from 83 datable lumber camps and their cultural and environmental associations have been considered, and the results of several tests are especially relevant for constructing similar studies for lumber industry sites in Lower Michigan.

This locational analysis represents perhaps the first formal attempt to develop predictive statements about logging camps in Great Lakes forests. It is somewhat biased in favor of late nineteenth- and early twentieth-century sites, as researchers admit, due to survey methodologies which emphasize road and railroad transportation features from this period. Nonetheless, this study integrates project-oriented research with theoretical design in a manner which can benefit both Forest Service cultural resource management and the archaeological community at large.

Drawing on a need for better understanding of settlement in Michigan's Upper Peninsula, Franzen (1984) has contributed a short paper on structural function and spatial organization within
nineteenth- and twentieth-century logging camps. Patterned after the historical model for the Hiawatha National Forest developed by Commonwealth Associates, Inc. (1984), this study utilizes both archival data and actual site layout maps. It is observed from this study that changes such as the introduction of railroad logging drastically increased the scale of logging operations. Furthermore, this growth, as measured in the size, spatial organization, and distribution of logging camps, is potentially applicable to comparable studies in northeastern Lower Michigan.

In a more management-oriented report, the Great Lakes Archaeological Research Center, Inc. (GLARC 1982), under contractual agreement with the Forest Service, has completed a multi-faceted series of guidelines to aid in the identification and evaluation of logging industry-related cultural resources on the Nicolet National Forest in northern Wisconsin. This long-awaited report represents perhaps the first comprehensive attempt in the Great Lakes region to provide a "cost-effective, non-destructive series of methods and techniques for evaluation of logging industry-related sites" (GLARC 1982:1). This project can be commended for two achievements: (1) a comprehensive plan to enable site-specific archival research and evaluation under criteria devised for determining a site's eligibility for the National Register of Historic Places, and (2) pilot investigations and extensive descriptive appraisals of a nineteenth-century logging camp which will surely facilitate future research designs.
Confronted with similar issues regarding the study and management of historic sites on public lands, archaeologists in the western United States have also recently directed research projects toward lumber industry archaeology. In their comprehensive historical overview of the Sierra redwood logging industry on the Sequoia National Forest in northern California, Brown and Elling (1981) have identified several types of logging-related cultural resources and have developed a research design which is intended to enable more specific site typology and formal evaluation. This report incorporates archaeological survey data with extensive information from archival sources, company records, personal files, and public documents, as well as from informants and local historical accounts.

Basically this study offers few new guidelines to cultural resource managers. However, the site typology which considers isolated artifacts, activity areas, linear features, logging camps, and historic landscapes as functionally discrete, may be applicable in future thematic logging studies as a means of categorizing different logging domains within the larger industrial realm.

Some of the shortcomings of the redwood logging study may have been instrumental in the development of *A Thematic Historic Logging Research Design* by USDA Forest Service archaeologists and others in the Far West (Tamez et al. 1983). Like Brown and Elling (1981), this comprehensive study presents nearly all conceivable methods of historic site reconstruction in one idealized framework. Yet, unlike
the redwood logging study, Tamez et al. (1983) focus on technological trends and economic processes as primary movers in the development of the lumber industry. Although archaeological data, specifically site age and function, are also considered, successful explanation appears to rely strongly upon the extant historical record. This type of design is well-suited for lumber industry studies in California and other western states where the industry was a relative latecomer and where technological methods such as steam loading, mechanized log handling, and railroad haulage combined the accumulated resources of westward expansion. Its thorough approach and synopsis of archival sources will certainly be helpful to researchers designing similar thematic studies.

The final archaeological report to be reviewed is an M.A. thesis recently published by the Forest Service, Northern Region (Knight 1981). Included here because of its systemic approach and use of historical analogy, this study investigates late nineteenth- and early twentieth-century lumber industry activities on the Lewis and Clark National Forest in central Montana. The Sheep Creek Timber Harvest and Transportation System, designated as one large site (24ME92), contains the remnants of multiple activity areas throughout the Sheep Creek drainage. These include several splash dams, log chutes, hauling roads, and stumplands. Archaeological inferences about the lumber industry are derived from historical accounts and examined with respect to environmental and cultural survey data. These hypotheses are then tested with site-specific historical
documents leading Knight (1981:72-78) to conclude that this seasonal cycle of timber harvest and log transportation accurately depicts the archaeological site data along Sheep Creek. Careful application of historical analogy, as exemplified by the Sheep Creek research, offers archaeologists one of the few nondestructive means of site assessment.

Organization of Study

Recent research undertaken to assess lumber industry archaeology has encompassed a wide range of topics. Since the initial historical overviews, archaeologists have concentrated on developing suitable theoretical and methodological constructs to facilitate this work. Subsequent contributions are just beginning to fill the information void and to close the paradoxical gap between the colorful lives of those boisterous and romanticized lumberjacks and the lumber industry — that relentless and voracious yet constructive mechanism to which they were vital.

A common thread which underlies archaeological research of the lumber industry is the use of the historical record as analogue and guide for studying its material remains. Although comparative analogy has long been regarded as a traditional archaeological method (Binford 1968; Watson, LeBlanc, and Redman 1971), Cleland (1983:37) points out that historical archaeologists have too often overlooked the value of using documents, maps, and oral history "as source[s] of data to be incorporated into the formulation of initial hypotheses."
Moreover, rather than applying these hypotheses to the archaeological record, archaeologists have attempted to use documentary data to independently test archaeologically derived hypotheses, a method which Cleland (1983:43) believes contributes little toward developing the research potential of historical sources.

The use of ethnographic and historical accounts to formulate hypotheses does not imply that cultural anthropology and history supplant scientific archaeological discovery. "All studies of the past are conducted by taking present objects (or present memories) as rules of the past and drawing inferences as to past events from them" (Spaulding 1968:37). Within the realms of cultural resource management and heritage-oriented research, or rather "the historical site preservation-restoration-reconstruction phenomena," South (1977:429) also cites a need for research design but cautions archaeologists not to base their conclusions solely upon existing historical accounts at the expense of archaeological data. Lewis (1977) emphasizes the prudent application of documentary data as a means of interpreting the past without lending bias to the results.

Documentary sources should not directly relate to the site under consideration. They may, however, refer to the sociocultural system of which it was a part to provide analogies useful in examining the archeological record (Lewis 1977:152).

Historical archaeology is clearly enhanced by the use of available documents, maps, and oral histories. Not only do these sources include data about past activities and material culture, but as Cleland (1983:43) observes, they also "provide insight into the
motivations and processes contributing to the formation of the archaeological record."

Under these premises, this study utilizes historical analogy to develop a model and testable hypotheses for historic lumber industry operations. Within a generalized framework of research design, these postulates are then compared with archaeological survey and environmental data as outlined in the following summary.

Chapter Three presents a history of the lumber industry in northern Lower Michigan and along the Au Sable River. Focusing upon forest-oriented logging operations within an annual cycle of timber extraction, this synopsis includes a discussion of nonmechanical logging methods and the influences of log transportation technology on lumber industry activities. Hypotheses for lumber industry archaeology are then presented for subsequent analysis.

Chapter Four describes the environmental setting of the study area along the Au Sable River, the logging industry sites under consideration, and the methods by which these data were acquired. Topography, soil, and timber types conform to the Landform Type Association (LTA) classification system utilized by the Huron-Manistee National Forests for forest-wide planning and management. This typology is correlated with a reconstruction of the presettlement forest which has been developed from the original General Land Office survey field notes and plats.

In Chapter Five cultural and environmental variables, selected on the assumption that they will most accurately reflect the existing
data, are analyzed with respect to the lumber industry expectations outlined in the logging model. Some of these results are then compared with those from similar analyses of lumber industry-related sites undertaken on the Hiawatha and Ottawa National Forests in Michigan's Upper Peninsula.

Chapter Six summarizes and discusses the results of this study, particularly with respect to the hypotheses presented in Chapter Three and their capacity to aid in the location, identification, and evaluation of lumber industry-related sites on the Huron National Forest. Concluding remarks weigh the success of this study with the prospects of alternative approaches in order to better delineate future research objectives for lumber industry archaeology.
CHAPTER III

HISTORICAL ASPECTS OF THE LUMBER INDUSTRY
AND EXPECTATIONS FOR LUMBER INDUSTRY RELATED SITES

The Nature of the Lumber Industry

Processes of resource exploitation form the root of the lumber industry. The degree to which a resource is used, i.e., the success of its exploitation, is governed by the value of the resource, its availability in economically suitable concentrations, and the technological means of accessing and utilizing the materials (McDaniels 1968). Declared the "Wooden Age" by one reflective nineteenth-century writer (Scribner's Monthly 1877), the lumber industry was with little doubt the backbone of westward expanding Euro-American settlement.

But with some little exceptions and reservations, it is safe to say that among the earliest elements in the settlement of a new country is lumber. The first things are — roofs over our heads; fences to protect growing crops; bridges to cross the streams; and before even the locomotive can reach us, there must be ties on which to lay the rails (Scribner's Monthly 1877:146).

From the viewpoints of early land lookers and settlers earnestly in search of pine for eastern markets, the Great Lakes forests were indeed bounteous. The comments of Wisconsin Congressman Ben Eastman to the House of Representatives in 1852 typified early land use attitudes.

Upon the rivers which are tributary to the Mississippi, and also upon those which empty...
themselves into Lake Michigan, there are interminable forests of pine, sufficient to supply all the wants of the citizens ... for all time to come (Twining 1983:124).

The dense forests were so tangled, wet, and dark as to invoke the human instinct to conquer, to open the land, let "daylight in the swamp" (Holbrook 1961:29; Rosholt 1980:5). Faced with such bounty, all that remained for the early lumber entrepreneurs was first to reach the pine with axe and saw, and second to bring the logs out to sawmill and market. Timber access, which is ultimately a question of transportation, proved to be the key challenge in the exploitation of Great Lakes forest resources.

Rector (1953) is perhaps the first historian to recognize the importance of transportation in the development of the lumber industry.

The study of transportation has usually been accepted, without realization that transportation was the one factor that controlled and influenced all other factors in the lumber industry. Land was made available, but it was the available transportation that dictated which acreages were acquired and which were bypassed (Rector 1953:29-30).

Economic geographers, however, have for years been grappling with the interrelationships between transportation, raw material location, place of manufacture, and subsequent settlement patterns within extractive industries such as lumbering and mining.

In the raw material-oriented lumber industry, from the earliest pine logging to modern hardwood and pulp operation, transportation remained the greatest cost factor. Its availability and variable
cost dictated sawmill location and relocation, timber value and
acquisition, even success or failure to the lumberman whose only
profit depended on his ability to move saw logs to the mill and
lumber to the consumer. The continued demand for cheap wood
products, coupled with increasingly efficient logging transportation,
sanctioned by the prevailing belief that the vast forests were
 inexhaustible, established land patterns that led to the near total
destruction of United States timber resources by the early 1900's
(Rector 1953; Sparhawk and Brush 1929).

"How the Woods Was Won"

By 1840 dwindling supplies of white pine in Maine and New York
were straining to meet the timber demands of eastern markets. Land
lookers representing lumbermen who sought new timber sources along
the northern pine belt were immediately attracted to the vast forests
of the Territory of Michigan but were discouraged by widespread
reports attesting to their "hostile Indians" and "interminable
swamps" (Hargreaves and Foehl 1964:2). These reports, thought to
have originated during the French and English fur trade competition
for exclusive Indian dealings, were a factor in limiting settlement
and exploitation of Michigan's natural resources for nearly two
centuries after Nicolet's penetration of the Upper Great Lakes in
1634 (Sparhawk and Brush 1929:6).

However, the eventual confirmation of Great Lakes pine wealth,
aided by the completion of the Erie Canal in 1825 (Hudgins 1958:44),
and the federal government's public land dispersal program, prompted the initial migration of northeastern lumbermen to Michigan. These hearty loggers, with their rugged lifestyles, logging practices, and tools, found that the timber supply and local geography matched well their particular expertise. It must be noted that these earliest lumbermen sought exclusively the white pine, or cork pine *Pinus strobus* to replace eastern supplies. As building material its ease of workmanship and light weight proved it to be far superior to the denser hardwoods and knotty conifers. The finest of Michigan's vast white pine stands spread naturally along its statewide network of rivers enabling access and inexpensive river transportation to the lake ports and mills. The Erie Canal, once the passageway west for timber-starved lumbermen, provided a return shipping corridor direct to the eastern markets.

By the middle of the nineteenth century midwestern settlements had not yet experienced the insatiable lumber demands found in the east. Most of the timber harvested in Michigan, Ohio, Indiana, and Illinois was used by the settlers to build log homes and sheds, to clear land for crops, or as firewood. Unused timber and stumps were usually burned in great piles. Though Michigan's earliest commercial lumber reportedly came from a small mill in St. Clair County in 1810 (Bissell 1904:42), the actual thrust of the Great Lakes lumber industry began in the Saginaw Valley about 1834 (Wood 1914:94) and developed steadily into the Civil War period. About this time early
logging operations were also budding in Wisconsin, Minnesota, and elsewhere in Michigan.

From Saginaw and Bay City the industry progressed across Michigan following in particular the accessible timber along river banks. Active sawmills and lumber centers sprang up at the mouths of the Muskegon, the Pere Marquette, the Manistee, the Au Sable, and other navigable streams. By 1869 Michigan led all other states in lumber production and continued at a feverish pace for the next 30 years, blossoming in the post-Civil War economy and again with the growth of lumber markets across the midwestern prairie states.

Railroad expansion into the still remote northern pine belt after 1870 further stimulated industry development not only by establishing new local lumber markets but by providing the first overland shipping services for logs and lumber to reach the larger midwestern cities (Jensen 1945:31). In 1876, Gerrish's introduction of the narrow-gauge railroad into logging operations marked the final demise of Michigan's pine resources (Kilar 1981:31). No longer were loggers restricted to harvesting only those stands which were accessible for the spring river drive. Traditional winter logging diminished as hundreds of short railroad spurs snaked year round into the hinterlands after the more isolated pine stands. Michigan sawmills, operating day and night, matched the increased supply of logs, reaching an all-time peak production year in 1889 when some 5.5 billion board feet of lumber were cut (Quinlan 1975:2). Soon after, Michigan's lumber industry slipped into decline. The once great and
seemingly inexhaustible forests were fast disappearing. Although skilled logging methods and expanded railroad technology visibly produced large-scale timber extraction during the nineteenth century, the chapter on lumber industry development was officially opened by the short-sighted programming of a land-rich but cash-poor U. S. Government. Designed to disperse millions of acres of public land into private ownership while generating government income, federal land grants and related legislation triggered much of the lumber industry's exploitive behaviors. Most of northern Michigan's timber resources were appropriated by lumbermen participating in these federal and state executed programs. The ensuing land use practices staged Michigan's settlement history for decades to come.

By the early 1900's U. S. Bureau of Corporations (BOC) investigations into the administration of the federal land grant programs and land acquisition laws had exposed countless cases of mismanagement and fraud at all levels. Large tracts of timber purchased early and for nominal prices experienced rapid increases in value as fewer tracts remained available amidst skyrocketing markets. Many lumbermen delayed harvest to await higher stumpage prices or to liquidate their investment at considerable profit. In his analysis of lumber industry organization, Jensen (1945:24) has found that the greatest fortunes were amassed through dealings in forested land rather than in the actual production of lumber. Similarly, U. S. Bureau of Corporations investigators found "vast speculative purchases and holding of timber far in advance of any use
thereof" (1913:xvii). In an example from Osceola County, Michigan, "400 acres of pine purchased in 1873 or 1874 for $6,000 were sold in 1881 for $25,000" (Danford 1942:358).

The enforcement of property boundaries presented another problematic obstacle to land policy administrators. Pressed by untempered greed, lumbermen devised peculiar logging conventions in order to glean as much timber as possible from their land. One practice, popularly known as the "round forty," became the "classic joke of the era" (Holbrook 1961:93). After purchasing a 40-acre parcel, usually the smallest unit of land exchanged, a lumberman would build a camp and send the cutting crews into the woods. When the boundary lines were reached, the crews were told to keep right on felling timber until not only their own forty had been leveled, but "all the forties around it" (Reimann 1952:28). Another practice was to cut up to the blazed boundary, then continue cutting "as far as you could see" (Reimann 1952:28). If caught and convicted of trespass, violators were merely fined the sale price of the land, usually $1.25 per acre (Holbrook 1961:93).

Adding further insult to policy makers, state tax regulations went largely unenforced throughout the Michigan forests. Timber was frequently assessed far below most other forms of property, resulting in untold revenue losses. Tax revenues were also defaulted by absentee landowners who resided downstate or in the east and who often evaded payment altogether (Sparhawk and Brush 1929:45). A final form of tax evasion by lumbermen was simply to cease payment on
their cutover lands. Lacking timber, these lands presented little future investment potential unless the soil was suitable for homesteading or agriculture. Thousands of acres of tax delinquent properties reverted to the state domain at the close of the lumber era. Many of these lands eventually formed the basis of our modern state and national forest systems. In the scramble for timber and easy profits, one hundred lumbermen went bankrupt for every one that succeeded. Even so, risk-takers feared no failure in the frontier economy. Few suffered serious loss when prime natural resources could "be bought for a song" or even $1.25 an acre (Sparhawk and Brush 1929:7).

Logging Along the Au Sable River

Lumber industry development on the Lake Huron shore and the Au Sable River basin mirrored that of other large Michigan streams. Situated north of the Saginaw valley, the Au Sable River pinelands were first exploited by Saginaw area lumbermen seeking to expand production at their Saginaw and Bay City mills. The earliest known settlement at the mouth of the Au Sable River was an Indian trading post operated by the Williams brothers around 1828 (Miller 1963:16). Whitefish and trout fisheries predominated in the earliest industrial developments, and transportation at the time was strictly by boat, foot, or across the ice in winter. In 1836 the firm of Howard and Van Etten constructed a small waterpowered sawmill at Van Etten Lake near the Au Sable River, but due to mechanical hardships, its owners
were forced to abandon the enterprise without sawing any lumber (Powers 1912:205).

Although they owned the property on the north side of the river by 1848 (Lewis and Headley 1870:4), it was not until 1865 that Backus and Brothers Lumber Company succeeded in building and operating the first sawmill at the mouth of the Au Sable River (Powers 1912:204). Four years later, after persuading the state legislature to permit log drives on the beaver dam and gravel-choked North Branch, the corporation of Smith, Kelley, and Dwight began river clean-up and logging operations at the headwaters of the Au Sable River, also known as Au Sable Heights (Hotchkiss 1898:63).

Pine lumbering progressed rapidly from both ends of the Au Sable River for the next two decades. The greatest economic growth occurred in the river mouth communities of Au Sable and Oscoda which in 1890 boasted a combined population of 8,346 (Sparhawk and Brush 1929:16). This number increased by several thousand seasonal workers during the height of the summer sawmilling. Lumber enterprises such as Loud, Gay, and Company (later H. M. Loud and Sons); Pack, Woods, and Company; the Oscoda Salt and Lumber Company; J. E. Potts (later the J. E. Potts Salt and Lumber Company); Gratwick, Smith, and Fryer; Moore, Alger, and Company; and Smith, Kelley, and Dwight were among the largest logging and sawmill concerns during the late nineteenth century (MacDonald 1942:26; Powers 1912:207-208; USDA Forest Service n.d.:6). (A more complete summary of lumber industry companies in the Au Sable River basin is presented in Appendix A).
River improvements, log dams, channelization, and extensive booming grounds to facilitate log sorting on the lower Main Branch, the North Branch, and the South Branch were well underway by the mid-1870's (Allen 1942:42). Also by 1872 early prospects of railroad transportation along the Huron shore had generated considerable excitement in Au Sable and Oscoda (Saginaw Daily Courier 1872:2). A twenty-one mile (33.6 km) narrow-gauge logging railroad and segment of this system began operating from Tawas City to the South Branch headwaters in Ogemaw County as early as 1878 (Powers 1912:186). However, the entire shore railroad, which later became the Detroit and Mackinac Railway, was not completed until 1901 (Powers 1912:188).

The J. E. Potts and Company railroad network, which served the Main Branch from Potts' headquarters at McKinley to Au Sable, was originally built as a narrow-gauge logging railroad during this period. Although one author reported this railroad was constructed in 1874 (USDA Forest Service n.d.:6), Ellis (1975:19) recalls hearing "about how the narrow-gauge railroad from Oscoda and Au Sable to McKinley was comin' along all through that winter of 1884-1885." William H. Ellis, a well-known boom foreman and lumberman who worked at the time for Gratwick, Smith, and Fryer, also noted that J. E. Potts "had four or five trains haulin' logs from his camps to the banks of the Au Sable" prior to the c. 1888 completion of the main line (Ellis 1975:17). John W. Fitzmaurice (1979:70) describes the J. E. Potts and Company as an extensive "force of about 450 men, 80 teams, seven locomotives and 32 miles of road." Beginning with its
purchase of the Backus and Brothers mill after 1871, the J. E. Potts Lumber Company, later the J. E. Potts Salt and Lumber Company, expanded and logged pine heavily along the Main Branch, the North Branch, and Perry Creek until finally selling under bankruptcy to H. M. Loud and Sons in 1890 (USDA FS n.d.:7). H. M. Loud and Sons renamed Potts' railroad the Au Sable and Northwestern Railroad and hauled logs and freight for the next 22 years (Powers 1912:189). Figure 2 illustrates some of these logging railroads and related early settlements in the Au Sable River basin.

Contemporaneous with the lumber camps and logging railroads in the Au Sable River hinterlands were the settlements of Damon, Mack City, Union Corners, and McKinley (see Figure 2). Usually occupied as long as the timber resources held or until the sandy soil played out, these communities served both the lumber camps and early farms by operating stores, blacksmith shops, post offices, churches, and schools. Mack City, originally called Long Lake, was settled in 1879 and abandoned in 1888 or 1889 (Pierce 1967:12). Predominately a farming community, Mack City predated Robinson's Railroad (c. 1908) which terminated just two miles south (USDA FS n.d.:7). Union Corners, c. 1878 to 1898, was also settled as a farming community (Pierce 1967:3). The coexistence of farming settlements with lumbering may have been more common than one would suspect. Reetz has found that the logging camps provided a local market for hay, and that a few lumber companies in Ogemaw County even established their own large farms (1951:29:30).
Figure 2. Settlements, logging sites, and railroads in the Au Sable River Basin, 1865–1920.
In contrast, both Damon and McKinley began as lumber company towns before the 1880’s (Humpal n.d.:1; USDA FS n.d.:3). McKinley, formerly called Potts, was the headquarters for the J. E. Potts Lumber Company and once contained some 800 permanent residents and as many as 2,000 men who worked in the surrounding forest (USDA FS n.d.:3). A steam engine-powered grist mill was erected in 1884 (Humpal n.d.:3). While the dismantling of Damon's post office in 1911 officially closed the town (Humpal n.d.:4), McKinley survived the end of the lumbering era, functioning today as a small resort community on the banks of the Au Sable.

Pine production along the Au Sable River increased steadily from about 1867, as depicted in Table 1, and reached a notable peak in 1887 when over 249 million board feet were driven down the river from the booming grounds (Fitzmaurice 1979:51). Soon after, the number of board feet dropped off and the demise of the vast pinelands and untrammeled wilderness disrupted the Au Sable River lumber industry much as it had in the Saginaw Valley and elsewhere. For the next five years lumbermen left the Au Sable River basin for other parts of Michigan, Wisconsin, and Texas. The populations of Au Sable and Oscoda decreased by more than 5,000 residents at the turn of the century, and by 1907 "an area of 300 square miles within 25 miles of Au Sable was reported to be totally uninhabited" (Sparhawk and Brush 1929:16).
Table 1

Pine Production on the Au Sable River from 1867 to 1887.

<table>
<thead>
<tr>
<th>Year</th>
<th>Board Feet Rafted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1867</td>
<td>48,800,000</td>
</tr>
<tr>
<td>1869</td>
<td>44,500,000</td>
</tr>
<tr>
<td>1871</td>
<td>52,000,000</td>
</tr>
<tr>
<td>1873</td>
<td>96,148,000</td>
</tr>
<tr>
<td>1875</td>
<td>55,000,000</td>
</tr>
<tr>
<td>1877</td>
<td>68,800,000</td>
</tr>
<tr>
<td>1879</td>
<td>113,000,000</td>
</tr>
<tr>
<td>1881</td>
<td>160,232,347</td>
</tr>
<tr>
<td>1883</td>
<td>230,000,000(^a)</td>
</tr>
<tr>
<td>1885</td>
<td>127,000,000(^a)</td>
</tr>
<tr>
<td>1887</td>
<td>249,072,865(^b)</td>
</tr>
</tbody>
</table>

Note. In part from Page (1883:190).
\(^a\) (Sparhawk and Brush 1929:8).
\(^b\) (Fitzmaurice 1979:51).

While most of the lumber companies pulled stakes for new domains, a few foresighted lumbermen assessed the changing industry and reorganized. The transition from pine logging to the harvesting of hardwoods occurred in Ogemaw County near the South Branch between 1884 and 1889 (Reetz 1951:46). Considering the dramatic losses in
pine production in 1885 (Sparhawk and Brush 1929:8) and the closure of dozens of Au Sable and Oscoda mills after 1890 (USDA FS n.d.:6), the eight-year period from about 1883 to 1890 most likely signified this transition throughout the remainder of the Au Sable River basin.

The first substantial hardwood operations were established in Ogemaw and Crawford counties by 1889 (Reetz 1951:46; Sparhawk and Brush 1929:9). Logging railroads superseded river drives as the major form of log transport, enabling the removal of denser, nonfloatable hardwoods and hemlock. Pockets of pine, once isolated within the great hardwood stands, were also harvested as a means of offsetting the loss of pine revenues (Sparhawk and Brush 1929:9). Exact figures of hardwood production for northeastern Lower Michigan and the Au Sable River were not extensively maintained (Bissell 1904:44). However, Reetz (1951:49) found the hardwood logging beneficial to the Ogemaw County economy citing that "the northern part of the county showed a much higher level of prosperity from 1890 to 1910 than it ever enjoyed in the pine era." The larger lumber companies successfully engaged in hardwood logging owned and operated a sawmill and held all or part interest in a logging railroad. One of the earliest hardwood corporations, the Maltby Lumber Company, began in 1889 in northeastern Ogemaw county (Reetz 1951:46).

In 1907 the Eastman and Robinson Lumber Company purchased the cutover pinelands of the absentee John McGraw Lumber Company and proceeded to harvest the remaining hardwoods (Reetz 1951:53). Although logging operations did not actually begin until 1909, the
construction of a new sawmill and Robinson's Railroad in 1908 initiated the settlement of Goodar, complete with residences, general store, post office, and hotel (Reetz 1951:53). Covering some 22 (35.2 km) miles of cutover lands between Goodar and Mio, this narrow-gauge railroad served two logging camps before its terminus "about 2 (3.2 km) miles south of the Mack Lake Ranger station" (USDA FS n.d.:7). Eastman and Robinson extensively logged areas south of the Au Sable River and around the South Branch until moving their mill in 1914 (Reetz 1951:50) and abandoning the railroad and their depleted lands in 1916 (USDA FS n.d.:7).

Along the Au Sable River's main branch, after taking over the J. E. Potts' Railroad in 1890 and renaming it the Au Sable and Northwestern Railroad, the H. M. Loud and Sons Lumber Company also "rolled with the changing times" past the turn of the century by purchasing cutover lands and clearing them of pine, hemlock, cedar, and hardwoods (MacDonald 1942:30).

The second decade of the twentieth century brought the final demise of the early lumber industry. Although Reetz (1951:50,59) notes that the pine plains experienced a short reprieve from about 1900 to 1906 as loggers gleaned the remaining jack pine, for all practical purposes the scant timber left could only sustain those few small operators with portable sawmills. As a bitter finale to the long and prosperous heyday, a sweeping fire completely engulfed Au Sable and Oscoda in 1911, wiping out most of the township including H. M. Loud and Sons, the last surviving lumber company and logging
railroad based at the mouth of the Au Sable River (MacDonald 1942:26).

Following the early lumber industry in northeastern Lower Michigan, most of those lands which had been burned over, stripped of timber, or which demonstrated no agricultural promise fell tax delinquent and reverted to the state. In the counties of Alcona, Iosco, Oscoda, and Ogemaw alone, these Tax Homestead and State Tax properties totaled 1,000,000 acres (Skeels 1898:7). Reetz (1951:41) has found that during the 1870's and 1880's some of the delinquent taxes were collected under protest while other losses were marginally recouped through cheap land sales, often to unscrupulous land speculators. Problems of tax loss were further compounded in Ogemaw County when township supervisors were unable to trace the records of some land ownership (Reetz 1951:41). On February 11, 1909, President Theodore Roosevelt proclaimed the inclusion of large portions of these counties and others within the boundaries of Michigan's first national forest, the Michigan Forest, later renamed the Huron National Forest (USDA FS n.d.:8).

Building Logging Camps

The pine being at last purchased, the [lumberman] has to plunge head first into the details of his winter's work. There are horses, harnesses, tin cups and tote wagons, pevey hooks and prunes, chains and chopping 'axes, beef biscuit and beans, 'van,' cook rooms, and bunk supplies, a foreman to get, a crew to hire, and a hundred items more. All these are cold, cast iron facts, without
as much sentiment mixed up in them as
would wad a gun. He looks with dismay at
the 'stubs' in his check book and begins
to wonder whether 'that piece of pine' is
going to pay (Fitzmaurice 1979:77).

As a business enterprise, the lumber industry has always
combined the elements of chance and calculated risk. Initial costs
of logging operations had to be met months before the logs reached
the mill. In turn, any profits gained were often not realized until
the close of the mill season, and barely in time for the next
winter's harvest (Bordin 1974; Brown 1949).

Once acquired, timberlands were assessed to determine feasible
methods of logging. The camp foreman, or "woods boss," was
responsible for site selection and for directing camp construction
and all woods operations (Fitzmaurice 1979:21,33). If several camps
were cutting for one company, a woods superintendent or "walking
boss" superseded the camp foreman (Rosholt 1980:86). Well placed
camps and road networks were vital to economical timber extraction.
Bryant (1914:56-57) outlines four criteria which governed site
selection: (1) proximity to the timber tract, (2) level, well-
drained ground, (3) fresh drinking water, and (4) accessibility to a
source of supplies. Beyond all other determinants, nonmechanical
winter logging operations required a centralized location within the
timber tract. Bryant (1914:56) emphasizes that "it is not considered
profitable to walk men more than 1.5 miles from camp to work ... becausethey consume too much time and energy." Brown (1949:62)
finds a distance of one mile (1.6 km) or 1.25 miles (2 km) by foot
and 20-30 minutes by rails to be most economical. This ride, taken at the most cost effective speed recommended for fully loaded narrow-gauge lines, 10 mph (16 km/hour) (Gillespie 1868:283), would presumably carry loggers 3.3 to 5 miles (5.3 to 8 km) from camp. In all, the distances from camp to work and from camp to the landings were judged to be about the same (Holbrook 1961:47).

In addition, the main haul road usually bisected the camp in order to reduce travel time with draft horses and oxen. As the camp to work distance increased during harvests in larger tracts, it was considered less expensive to construct a new or secondary camp (Bryant 1914:56). Level, dry ground and access to clean water such as that from a spring or well were also required for health and sanitation and to provide drinking water for the stock (Brown 1949:62; Bryant 1914:56). Bryant (1914:57) also notes that the water supply at railroad logging camps was often brought in by tank car and, in an additional comment regarding the selection of year-round railroad camps, stresses the importance of a well-drained site away from the swamps and the threat of malaria-infested mosquitoes.

The distance from camp to town or other source of supplies, while important, was less of a locational factor in camp construction. For camps following the depleting timber in the 1880's, little thought was given to situating a winter camp 35 or even 50 miles (56 or 80 km) from town (Fitzmaurice 1979:22). Usually in late August or early September, before the camps were built, the "road monkeys" cut and cleared a primitive tote road over which the
teamsters wagons or sleds hauled all of the camps' supplies and equipment (Hargreaves and Foehl 1964:14). For railroad camps, supply cars were conveniently added as needed on the return trips.

Camps were constructed according to the amount of timber to be cut, and consequently, the estimated length of occupation varied with the crews and team size. Whittemore's 1854 journal account of his operations at Tawas City, Michigan, reported that new camps were required almost every season (Bordin 1974:36). Brown (1949:62), however, estimates that most northern camps were generally occupied for two years. Portable railroad car camps, those in which the cook shack and crew quarters were built on railroad flat cars, may have been used for 10 or 15 years (Brown 1949:64). Barns and stables at portable camps were usually semi-permanent structures (Bryant 1914:64). Fitzmaurice (1979:21) observes that one season's cut of 10 million board feet at a late 1880's pine logging camp in Presque Isle County, Michigan required a camp for 100 men and 12 teams. Finally, Ellis (1975:50) recalls that the H. M. Loud Company built a second camp in Alcona County, Michigan, "in the timber maybe three miles" from the first log camp, and about two years later, in 1887, built a third.

After the timber was cut, camps were most often abandoned even in the twentieth century (Brown 1949:63). The empty camps may have stood for several years unless leveled by fire. In 1878, several structures at the deserted Camp Erwin near Thompson's Farm in Iosco County, Michigan, had been reused as a hunting camp (Scribner's
Some of the later railroad logging camps, many built of boards and covered with tar paper, were dismantled and relocated (Bryant 1914:61), although Brown (1949:63) recalls that some structures were usually left standing. In either event, doors, window frames, and other fixtures were often removed to the new camp (Brown 1949:63).

Several types of logging camps have already been mentioned. The numbers and kinds of structures built at these camps may provide clues for archaeological expectations about the remains of lumber industry sites. In addition, changes in camp size and layout may reflect new logging practices or technological innovations.

In the 1850's and 1860's some of the earliest pine logging camps contained one or two structures sturdily built of horizontal or cribbed logs which were corner-notched and chinked with moss or mud. Low, gabled roofs of bark and eventually cedar shakes predominated until both were replaced by pole timbers and tar paper (Bryant 1914:56; Hargreaves and Foehl 1964:15; Holbrook 1961:44). Each major structure was banked with an earthen berm as a means of discouraging cold winter winds (Ryan 1976:49-50). Today, these embankments may represent the only remaining surface evidence for many early logging camps, as well as provide an indicator of winter occupation. One of the log buildings served as a combination cook shack, dining room, and bunk shanty at the earliest camps. Meals were cooked over a central fireplace of sand and stone under an open vent in the roof. Beds, which usually consisted of two tiers of
wooden platforms along two or three walls, were padded with hemlock boughs or hay and slept two men per bunk (Hargreaves and Foehl 1964:15). The other structures, if present, housed the oxen and very likely the teamsters who often found the clean straw of the oxen hovel, or barn, more inviting than the cramped, smoke-filled shanty (Holbrook 1961:45).

Rosholt (1980:82) notes that in Wisconsin logging camps from 1840 to about 1870, log shanties rarely contained windows and had only one door which opened toward a river or spring. Crew sizes were usually quite small before the 1870's, often consisting of only five or ten men who worked for a jobber or other small-scale operator (Rosholt 1980:85).

In the early 1870's wood heating stoves began to replace the central open fireplace (Rosholt 1980:84). About this time separate log structures were often constructed for the cook shack, sleeping shanty, and blacksmith shop. Camp Erwin, previously mentioned as having been abandoned and reoccupied by 1878, was described as consisting of an old barn, a blacksmith shop, and a house which contained "on the upper floor, one large and finely ventilated apartment; and below, the kitchen, dining and 'living room' and two small bedrooms" (Scribner's Monthly 1878:758). However, in the winter of 1870-1871 much larger camps were also in operation. Near Big Rapids, Michigan, one camp contained six log buildings situated conveniently near together and of sufficient capacity to accommodate seventy men, twenty pairs of horses, seven pairs of oxen (Saginaw Daily Courier 1871:2).
The structures were described as follows: (1) cook shanty, 20 x 62 feet (6.1 x 18.9 m), one story; (2) men's shanty, 20 x 36 feet (6.1 x 11 m), one and one-half stories; (3) barn with two stables on either side, 52 x 58 feet (15.9 x 17.7 m); (4) granary, or small storage building; (5) combined blacksmith shop and woodbutcher's shop; and (6) a small building used by the camp storekeeper and his family (Saginaw Daily Courier 1871:2). Outhouse facilities, rarely evident in early logging camp photos or descriptions, most likely consisted of the "camp trench," an open ditch about 10 or 20 feet (3 or 6.1 m) long over which a wooden stringer was suspended (Rosholt 1980:105). Ryan (1975:24), however, notes that outhouse buildings were used in the larger, and somewhat later, Minnesota camps.

By the 1880's and 1890's several functionally specific structures predominated logging camp design. As the use of horse teams increased over that of oxen, camps required larger barns and stables (Rosholt 1980:83). A "van" or "wanigan" building was included to serve as the foreman's office and the camp commissary at which loggers could purchase or charge the winter's necessities such as socks, mittens, or tobacco (Bryant 1914:58; Holbrook 1961:46). Earthen root cellars, usually dug from a hillside and enclosed with boards, were used to store fresh meat, milk, and vegetables (Rosholt 1980:97). Some root cellars were attached to one side of the kitchen and topped with dirt to improve their insulation (Ryan 1975:24-25). Fitzmaurice (1979:22), who visited hundreds of northern Michigan logging camps in the late 1880's, described a typical camp of that
time as serving 100 men and 18 teams and consisting of five major buildings, including the "van", a barn and stable, a blacksmith and woodbutcher shop, and a "cook camp" measuring 35 x 65 feet (9.1 x 18.3 m).

With the advent of railroad logging, close proximity to the cutting tract was no longer as critical for camp location (Bryant 1914:57). The operation of large camps was likely more economical because the crews could be transported to and from a larger area. Crew sizes of 75 or 100 men were not uncommon (Fitzmaurice 1979:22,23). In addition, a map produced in 1893 by the Michigan State Board of Health Inspectors illustrated H. M. Loud's railroad "Camp No. 8" located in Alcona County, Michigan, as part of a report on diphtheria outbreaks (Mich. Dept. of Health 1894:187). This map, reproduced in Figure 3, shows 17 buildings and four wells, including six houses, two sleeping camps, a cook camp, a blacksmith shop, horse stables, a railroad grade and roundhouse, a sewage pipe, and an outhouse. Although no data for actual crew size were listed, both single men and families with children lived at this year-round camp. William H. Ellis (1975:46) worked at the "Loud Company's Camp Eight" west of Harrisville, Michigan, through the summer of 1887 and the following winter, cutting pine long timbers to be rafted to New York. Apparently, over several years, the Loud Company built three "Camp Eights." He (1975:50) notes that "the Old Camp was built of logs and was the biggest camp of them all." Moreover "new Camp Eight, built in the timber maybe three miles from the Old Camp," may
Figure 3. Diagram of the H. M. Loud Lumber Camp No. 8 in Alcona County, Michigan.
have been constructed of board and tar paper because Ellis (1975:50) remembers that that summer he lived in the "Board Camp" and that it had "been in use for two years." He (1975:46) also mentions that they had a board camp along with the log camp to house the men that was workin' there. There was upwards of two hundred men and them two hundred ate in the big dinin' room, all but the loaders and teamsters.

The third Camp Eight was constructed "right after that" (Ellis 1975:50). Although it remains unclear which Camp Eight is depicted in the 1893 diagram, all three were apparently quite large.

On the other hand, smaller camps still prevailed. Between 1908 and 1916 two Eastman and Robinson Lumber Company railroad camps in the northeastern Lower Michigan counties of Ogemaw and Oscoda housed about 65 men each (Reetz 1951:53). Also, contracted jobber camps continued throughout lumber industry history. These camps were usually smaller and more temporary, often lasting only one season (Jensen 1945:51-52). However, depending upon the extent of the timber contract, jobber camps probably varied considerably in size and length of occupation.

Woods Work and Log Transportation

Cutting operations commenced as soon as the camp quarters, barns, and cook shack were completed, usually by October. Michigan's northern climate proved conducive to early logging technologies. Freezing temperatures and blankets of snow covered the understory brush and enabled enormous logs to be snaked, skidded, and sledded.
over ice-packed roads to the stream banks or railheads. All winter long the timber was harvested with an exhausting vengeance, not only to abide by the financial constrictions of the investors, but to compete with the production rates of other sawmills. Prior to the use of the narrow-gauge logging railroads for hauling logs to the mills, it was imperative for loggers to have the requested timber cut and banked in time for the winter break-up and spring river drive, or otherwise risk the loss of a year's profits (Ellis 1975:62).

Nineteenth-century Michigan loggers, more commonly called shanty boys, performed all of the woods work in the early lumber industry. Bulger (1979:iii) has pointed out that the term "lumber jack" came into existence around 1896 and gained widespread use in the twentieth century. From October through March these early loggers faced a rigorous daily routine. It has been said that "the lumberjacks never saw the camps in daylight except on Sundays until the camp broke up in the spring" (Reimann 1952:58). Rising to the cook's wake-up call around 4:30 a.m. (Hargreaves and Foehl 1964:17), the loggers ate the second shift breakfast after the teamsters who had preceded them by nearly an hour. After the camp foreman issued directions for the day's work, small crews of three or four men tramped off to the cutting grounds where the teamsters had already begun hauling logs (Saginaw Daily Courier 1871b:2). A hot noon meal was brought out on a sleigh by the cook's choreboy. The crew helped him with the fire by digging a fire pit and burning "big, pitchy pine knots" (Ellis, 1975:7). The cutting, skidding, and hauling then resumed until "it
was too dark to use an axe" (Reimann 1952:58), and then the men
returned to camp. In the evenings, the aromatic smoke from after
supper pipes combined with the warm, steamy odor of wet wool socks
and mittens and permeated the shanty. Around 9:00 P. M. the loggers
retired to their bunks. Shortly after the crackle of the stove
subsided, the only sounds to be heard were the ragged snores of the
exhausted men and the wind whistling through the chinks (Hargreaves
and Foehl 1964:17; Holbrook 1961:50). This routine apparently
changed little during the hardwood era (Reetz 1951:56,195). Ellis
(1975:50), however, remembers a summer in 1887 when the bedbugs were
so fierce in camp that "we slept out in the woods ... most of the
time." After 1886 the ten-hour work day had generally become
standardized (Holbrook 1961:106), and loggers frequently rode the
train to and from work.

Rector (1953) points out that transportation comprised the root
of the lumber industry. After a tree was felled, limbed, and bucked
into lengths, it was skidded, loaded onto the sleigh, and hauled to
the banking grounds or decking areas. In short, log transportation
began as soon as the tree hit the ground. Brown (1949:1) divides the
log transportation process into two stages: (1) "minor transportation,
or log assemblage," and (2) "major transportation, or main
haul." The types of minor transportation most widely utilized in
Michigan's early lumber industry included snaking and skidding by
horse or oxen team. Major transportation forms consisted of the sled
haul, river drive, and the logging railroad. A lumber company may
have used two or more methods of major transportation in the same operation (Brown 1949:129-130). This study considers portions of both stages while focusing upon the movement of logs from the stump to the departure point of the longest haul, i.e., the stream bank or the primary railhead.

**Felling Timber**

Generally, one swamper and two sawyers comprised each felling crew. Before the mid-1870's trees were customarily felled by an axe, then cut up with the two-man crosscut saw while on the ground (Rosholt 1980:41). Once felled, the tree was limbed by the swamper, who was also responsible for brushing out and clearing windfalls from the skid trail (Rosholt 1980:12). The sawyers then bucked each bole into standard lengths, usually from 8 to 16 feet (2.4 to 4.9 m), depending upon the length of the sleigh, railroad car, or sawmill carriage (Brown 1949:120-121; Ellis 1975:7; Rosholt 1980:41). The bark on the butt end of each log was often "rossed," or stripped from the underside, to reduce drag during skidding (Fitzmaurice 1979:73). Along the Au Sable River, Ellis (1975:7) recalls observing as many as 70 men working on a stand of pine, "a lot of it four feet thick on the stump ... so thick you can't hardly turn around."

**Skidding Logs**

Using horses and oxen, various tools, and sled-like devices, the skidding teamster snaked and skidded logs along the ground to the
skidway, or to the nearest sleigh road. By the 1880's, when Fitzmaurice (1979:73) visited scores of logging operations, the use of skidding tongs had largely replaced the old hook and chain method of dragging logs over the snow. Similar in function to very large ice tongs, skidding tongs proved to be extremely efficient for very short distances (Rosholt 1980:118).

In the Great Lakes region, wooden skidding sleds such as travois, go-devils, and drays were used to elevate the front end of the logs (Brown 1949:142; Bryant 1914:146). Built from hardwoods by the camp blacksmith and woodbutcher, the forked go-devil was a rough sled having two unshod hardwood runners ... selected from timber having a natural crook. The usual type of runner was from 6 to 7.5 feet [1.8–2.3 m] long, and from 3 to 5 inches [7.7–12.8 cm] thick (Bryant 1914:155–156).

The dray, or "jumbo dray," was used for longer distances, from 0.25 to 0.75 miles (402 m to 1.2 km) (Bryant 1914:157,159). Also constructed by the camp blacksmith, the jumbo dray contained two sleds, or "twin-sleds, similar in construction to go-devils, joined together by cross-chains, with a distance between bunks of about 9 feet [2.7 m]" (Bryant 1914:159).

In 1870, shortly before the introduction of the narrow-gauge railroad, an innovative wheeled horse- or oxen-drawn skidder was invented in Manistee, Michigan, and gained widespread acceptance (Rosholt 1980:60). "Big wheels," an axled pair of iron-rimmed wooden wheels which usually measured from 7 to 11 feet (2.1 to 3.4 m) in diameter, could drag a bundle of logs up to one-half mile (805 m)
chained beneath the axle (Brown 1949:141-142). This skidder required neither manicured trails nor snow cover and subsequently permitted the extension of timber harvesting into the summer months.

Conventional animal-powered skidding was restricted to distances of about one mile (1.6 km) or less in order to conserve the stamina of oxen and horses throughout the cutting season and to obtain the greatest work output for feed and care expenditures (Brown 1949:148-149). Even though the slow moving oxen were largely replaced by horses after 1875, and draft horses around 1910 (Rosholt 1980:13), skidding distances remained roughly the same. By the late 1870's the success of the steam-powered logging railroad had encouraged further experimentation in mechanized skidding and log loading equipment. In 1883, Horace Butters received the first patent for a steam-powered overhead cable skidder which lifted logs out of the brush and swamps at his Ludington, Michigan, operations (Bryant 1949:196). Ellis (1975:46) writes that in the later years, probably between 1890 and 1911, H. M. Loud used a steam skidder and cable to pull logs directly to his main railroad and spur line. However, while power skidders and loaders gained popularity in the South and Far West, few were ever extensively used in the Great Lakes region.

The narrow and compacted skid trails led to a network of more substantial sled roads which converged at the skidway, landing, or yard, where the logs were decked for the longer haul by sleigh or rail (Brown 1949:293; Bryant 1914:161). Bryant (1914:161) describes the main skid road as 5-6 feet (1.5-1.8 m) wide, cleared of stumps,
and slightly graded. Cribbed bridges were built across small streams, and swamps were corduroyed with timbers.

The form of the stacked log deck at the skidway varied with the method of hauling. For a sled haul, the logs were tiered 10 to 30 feet (6.1 to 9.1 m) high by a four- or five-man crew and one team (Bryant 1914:140-141). A hillside or log frame served as the holding structure. Using a heavy "crosshaul chain" and the team, the loading crew pulled a log up "two pole skids" to the top of the deck where a man waited to guide its placement (Bryant 1914:141-142). Sled haul skidways were situated at points along the logging roads (Brown 1949:291). Skidway sites for a railroad haul consisted of an area "not lower than the track" which was cleared at least 40 feet (12.2 m) away from the grade to permit travel space for crosshaul loading by the team (Bryant 1914:143). Logs were stacked parallel to the grade and upon "two continuous rows of poles placed about 8 feet [2.4 m] apart and extending at right angles to the track for a minimum distance of 100 feet [30.5 m]" (Bryant 1914:143).

The Sled Haul

Once assembled at the skidway, logs were hauled to the major transportation departure point, i.e., the stream bank or railhead, or directly to the mill if distance permitted. Sled hauling usually began in middle or late December, when temperatures and snow cover provided a firm base for the runners, and continued uninterrupted until the snow melted (Bryant 1914:167). The type of sleigh which
predominated in the lake states was built at the camp's blacksmith shop and varied somewhat according to custom. Brown (1949:288) explains that these heavy hardwood sleds were similar but larger than the twin-sled drays and were shod with curved steel runners.

The construction of sled roads for the winter haul was supervised by the camp foreman and accomplished before the ground froze. Conventional logging roads "follow a downhill haul from the place of felling to the logging storage at the sawmill or point of delivery" (Brown 1949:129). Bryant (1914:163) adds that these roads often follow the valley of some stream through the woods operation to the landing, crossing and recrossing the watercourse as often as necessary to maintain the desired grade.

After clearing a right of way, the road monkeys graded and prepared the road much like the skid roads, i.e., stream crossings were bridged and swampy areas were laid with corduroy. Frequent road turnouts were also built to permit loaded sleds to pass the empties. Finally, Hill (1893:706) observes that "the roadbed is sunk instead of raised, so that the sleighs will not 'slew'."

Ongoing maintenance was conducted each night and consisted of plowing snow from the right of way, cutting ruts for the runners, and icing the ruts to reduce friction. The horsedrawn sprinkler, a wooden tank on sleds, carried water which when sprayed over the ruts froze instantly to a solid sheet. Fitzmaurice's (1979:71) observation regarding sprinklers as "the first great mechanical improvement ... used for making the 'log road'" suggests that they
had been used prior to 1889. To retard speed on descending grades, a layer of hay or sand was packed into the ruts. On steeper slopes, rope snubbers were wrapped around stumps and played out by hand (Brown 1949:292-293).

The documented length of the sled haul varies. At a Michigan pine camp in 1871, it was reported that the camp was two miles (3.2 km) from the river, and that the oxen teams managed five trips per day (Saginaw Daily Courier 1871b:2). Based on his knowledge of modern pulpwood operations which still used horse teams, Brown (1949:283) suggests that the sled hauls were usually no more than 2 or 3 miles (3.2 or 4.8 km) in length. However, in 1879 and 1884, two immense loads, each weighing over 70 tons (63.5 metric tons), were reportedly hauled 3 to 4 miles (4.8 to 6.4 km) to banking grounds on the Au Sable River (Oscoda County News 1971:8; USDA FS n.d.:6). This distance concurs with Ellis (1975:30) who recalls that during the winter of 1886-1887, when he worked at the Pack, Woods, and Company camp, the sleigh hauls ranged from 3.5 to 4.5 miles (5.6 to 7.2 km).

Logging Railroads

Four types of "railroads" were used to haul logs: pole roads, tram roads, narrow-gauge, and standard-gauge. Some confusion surrounds the historical classification of the earlier pole and tram roads. Fitzmaurice (1979:67) speculates that the "tram road" was first used in Michigan "fully thirty years ago ... [for] the hauling for comparatively short distances of logs from the skids to the

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banking ground." Pole roads followed, and according to Fitzmaurice (1979:68), "twenty years ago every foundry in Michigan and Wisconsin was run to its utmost capacity to furnish 'sheave wheels' for the 'pole roads'." Brown (1949:329-330) classifies these earliest railroads as "pole roads" and "stringer or tram roads," and notes that the crude rails were fashioned from "round logs or poles and sawed stringers." In 1914, Bryant's (1914:242) illustrated description states that the pole roads were constructed of lapped poles which were hewn along "the inner face to reduce friction on the wheel flange." Functioning by gravity, they were "seldom built for distances greater than from 2 to 2.5 miles" (Bryant 1914:242). On the return trip draft animals pulled wooden cars built over four wide, slightly concave wheels.

The primitive pole road was replaced by the more versatile stringer road, a continuous double layer of narrow hardwood boards which were spiked to round wooden crossties (Bryant 1914:245-246). Strips of strap iron were sometimes laid along the surface to retard wear. Draft animals or gear-driven steam locomotives supplied the power to haul the "light-weight, 2-truck, 8-wheel skeleton car" (Bryant 1914:247). Based on these descriptions, Whittemore's "so-called railroad" built in 1855 using "hard maple ribbands" for tracks and extending from Tawas City, Michigan, into the interior (Bordin 1974:39) was likely the first tram road along the Huron shore.

Gerrish's successful use of steel rails in 1876 is documented as Michigan's first logging railroad (Bryant 1914:247). Narrow-gauge
railroads for logging spread rapidly because they facilitated year-round accessibility to remote timber and enabled the transportation of hardwoods. They also required less stringent roadbed and grade specifications (Bryant 1914:218-219). While standard-gauge railroads were used primarily as common carrier trunk lines, Rector (1953:202) observes that the function of most logging railroads "was to serve as feeders to the driving streams, thus removing some of the loggers from dependence upon freezes and snow."

The historical development of logging railroads in the Au Sable River basin has already been discussed. However, several characteristics pertaining to railroad construction suggest leads for archaeological expectations. Because they comprise the vast majority of logging railroads along the Au Sable, narrow-gauge lines are emphasized.

Brown (1949:333) states that the purpose behind logging railroad location was to develop a cost-effective "network of main and spur lines to move all the merchantable logs from a given area to a distant point." Line locations should also accommodate the type of minor transportation in use. Topography permitting, where animal teams were used, spur lines were "preferably located so that the maximum haul from any point of the operation will not exceed one-fourth mile [402 m]" (Bryant 1914:253). Brown (1949:334) further points out that to reduce expenses, spur lines were usually laid along the natural grades provided by creeks and draws, while the more substantial main line might crosscut the topography. In areas of
intensive railroad logging, the resultant landscape of lines and
spurs formed a dendritic pattern.

Similar to the construction of standard-gauge roadbeds, primary
narrow-gauge grades were customarily elevated and filled to a width
of about 8 feet (2.4 m) (Brown 1949:335). They were also ballasted
for drainage with "broken stones, gravel, quarry rubbish, cinders,
etc." (Gillespie 1868:295). Ditches along either side provided
drainage and fill for grade embankments (Gillespie 1868:54). These
ditches are now commonly called "Swede holes," so named after the
many Swedish immigrants who helped construct Michigan's logging
railroads (Ellis 1975:142). The hundreds of temporary spur lines
were frequently built without ballast (Brown 1949:295; Ryan
1975:36). In swampy places along the Au Sable River and elsewhere,
this practice took its toll more than once when locomotives and cars
were permanently lost in sinkholes (Humpal n.d.:3; Ryan 1975:36).

Railroad crossties were usually cut during road construction or
at small contracted "piece work" camps (Brown 1949:56). After the
timber was cut and hauled out, the rails and ties were taken up and
moved to the next location (Brown 1949:335).

Hypotheses

A number of archaeological expectations for the nineteenth- and
early twentieth-century lumber industry in the Au Sable River basin
can be drawn from the historical account presented in this chapter.
Certain limitations have been dictated by the prescribed project
The following postulates or hypotheses are considered:

**Hypothesis 1: Chronology of Logging Along the Au Sable River**

A three stage chronology is proposed for the development of the lumber industry in the Au Sable River drainage (see Table 2). This framework is based on a series of inferences from historical data including: (a) the first mills were constructed in 1865 to saw lumber from pine which was brought downriver during the spring drives; (b) the advent of the region's first steam-powered logging railroad around 1885 enabled more distant stands of pine, and also hardwoods, to be cut; (c) allowances must be made to accommodate Brown's (1949:134) contention that a "considerable overlapping of methods" occurred during the depletion of the floatable pine timber when numerous companies were terminated.

### Table 2

**Chronology of Michigan's Lumber Industry in the Au Sable River Basin, 1865-1916**

<table>
<thead>
<tr>
<th>Era</th>
<th>Time Period</th>
<th>Major Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine</td>
<td>1865-1882</td>
<td>River Drive</td>
</tr>
<tr>
<td>Transition</td>
<td>1883-1890</td>
<td>River Drive/Logging Railroad</td>
</tr>
<tr>
<td>Hardwood</td>
<td>1890-1916</td>
<td>Logging Railroad</td>
</tr>
</tbody>
</table>
Hypothesis 2: Building Logging Camps — Camp Structure

Increases in logging camp size are related to developmental changes in logging methods and technology (see Table 3). This hypothesis is based on documentary evidence that pine era/river drive camps in the 1870's commonly contained from three to six log structures near an associated railroad.

Table 3

Proposed Increase in Logging Camp Size in Nineteenth- and Early Twentieth-Century Michigan

<table>
<thead>
<tr>
<th>Major Transportation</th>
<th>No. Structures</th>
<th>Est. Occupation Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Drive</td>
<td>1-2</td>
<td>pre-1870</td>
</tr>
<tr>
<td>River Drive</td>
<td>3-6</td>
<td>1870-1880</td>
</tr>
<tr>
<td>Logging Railroad</td>
<td>&gt;6</td>
<td>post-1880</td>
</tr>
</tbody>
</table>

Hypothesis 3: Building Logging Camps — Timber Associations

Pine logging/non-railroad camps would be well surrounded by pine timber while pine and/or hardwood/railroad associated logging camps would be located either in mixed stands or along the margin with access to both pine and hardwood timber. This hypotheses is derived from historical evidence indicating that nonmechanical logging operations demanded a centralized location within the timber tract and required not more than a 1.5 (2.4 km) walk to the cutting area. By contrast, railroad operations — with or without the river drive

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as the major form of transportation — permitted longer distances between camp and work, i.e., up to 3-5 miles (4.8-8 km).

Hypothesis 4: Woods Work and Log Transportation

Logging camp sites that lack direct railroad association and which are located no further than a total of 6 miles (9.6 km) from a drivable stream may have been winter camps built to cut pine, cedar, and possible hemlock. This hypothesis is drawn from documentary data which suggest that non-railroad log transportation techniques, involving sleds, nonmechanical skidders, and twin-sleds, restricted loggers to cutting timber within a 1.5 mile (2.4 km) walk of camp and 4.5 miles (7.2 km) of the banking grounds.
CHAPTER IV

PRESENTATION OF DATA

This chapter presents the archaeological site data within the environmental setting of the Au Sable River study area. Although generalized ecological descriptions for the Huron National Forest have already been presented (see Lovis, Langhorne, and Van Arsdale 1978), this discussion focuses on the presettlement forest conditions as reconstructed from the original General Land Office surveyor field notes and plats. The reconstruction is incorporated into the Huron-Manistee National Forests Land Type Association (LTA) system as a planning tool to aid in locational analysis. Following the environmental background is an account of the field methodology and documentation utilized in site data recovery. The chapter concludes with a narrative description of the 18 lumber industry-related sites to be analyzed in this study.

Physiographic Characteristics of the Study Area

The study area encompasses about 324 square miles (829 km²) along the middle segment of the Au Sable River basin in northeastern Lower Michigan. Bounded on the north and south by the upland limits of the watershed, by highway M-33 on the west, and along a north-south line approximately through the community of Glennie on the east, the study area incorporates a large part of the Huron National
Forest in the counties of Alcona, Iosco, Ogemaw, and Oscoda (see Figure 1).

The Au Sable originates only a few miles from the Manistee River in the high plains of central northern Michigan, yet drains to the opposite side of the peninsular divide. Flowing generally southeast for at least 100 miles (160 km), the Au Sable drops some 669 feet (204 m) from its branched headwaters to Lake Huron (State of Michigan 1980). Its swift waters and churning rapids cut a deep valley between the Port Huron Moraine and the hilly West Branch Moraine before crossing the glacial lake plain along the Lake Huron shore (Davis 1935:Maps 8-9; Hudgins 1958:Fig. 13). Flanked by sandy pine plains and high rolling moraines, the Au Sable River is thought to have been named by the early French for its bed of sand and gravel (Miller 1963:11). By the nineteenth century, local bands of Chippewa and Ottawa called it Mud-au-bee-be-ton-ange, which was translated to mean "'flowing or coming from the interior to the lake'" (Miller 1963:16). An early deer hunter also rather eloquently described his first view of the Au Sable.

We came out of the forest abruptly on the edge of a high sandbluff and there it lay about one hundred and fifty feet below us ... Its waters were the color of dark brown sherry, and its current was silent, swift and powerful. Beyond, the bank was low, and the forest stretched back over successions of slightly rising plateaus to the horizon. Here and there one could see the scars of fires, and a sinuous track of the darkest foliage revealed the tortuous course of the Au Sable (Scribner's Monthly 1878:759).
As described by Lovis et al. (1978:29) the Huron National Forest lies primarily within the Canadian Biotic Province. This conifer-hardwood forest attains several sub-climatic pine associations prior to reaching a deciduous climax in which sugar maple, American beech, basswood, and other hardwoods predominate over white pine, spruce, and balsam fir in most areas. On the drier sandy plains, jack pine, several species of oak, and quaking aspen comprise the primary timber.

To date, the Huron-Manistee National Forests Land Type Association (LTA) system distinguishes between 18 different landform-soil-vegetation categories. Seventeen of these groups have been identified on the Huron National Forest (see Appendix B).

Presettlement Forest

Although generalized maps of the presettlement forest composition are available (Greeley, et al. 1923; Veatch 1959), it is expected that a more detailed rendering of the early forest would strengthen the local assessments of lumber industry-related sites. To meet this objective, the study utilizes the original General Land Office (GLO) surveyor field notes and plats for northeastern Lower Michigan. These documents have been successfully used to reconstruct presettlement forest patterns since the early 1900's (Bourdo 1956; Davis 1935; Hushen, Kapp, Bogue, and Worthington 1966; Kapp 1978; Kenoyer 1933).
Bourdo (1956) summarizes the methods by which these surveys were conducted and offers certain precautions for researchers who consult GLO survey data. Surveyors were instructed to double blaze and record the course and direction for four bearing trees at all township corners and section corners along both township and range lines. In some survey years, "witness trees," those which were blazed but not measured for course and direction, were also located at township and section corners, although the terms "bearing tree" and "witness tree" were frequently used interchangeably. Although the instructions varied somewhat from year to year, only two and sometimes up to four trees were customarily recorded at interior section corners. The species, diameter in inches, direction, and distance from the corner in links were noted for each bearing tree. In addition, two bearing trees were documented at all quarter corners. Usually two or three trees encountered during the running of township and section lines were also double blazed and measured for diameter and distance. After completing the entire township, the surveyor drew a township plat which illustrated his observations, actual timber patterns, windfall patches, water bodies, swamps, topography, and noteworthy cultural features such as mining camps, sugar camps, and trails (Bourdo 1956:757-759).

Even though they have proved to be accurate for various levels of forest reconstruction, GLO survey data are still customarily utilized only after their potential biases have been considered. For example, the preference of some surveyors to select a certain tree
species for its smooth bark or accessibility rather than for its vitality or durability, and the occasional falsification of survey records are known to have resulted in instances of unsystematic and nonrandom data (Bourdo 1956:759). However, Bourdo also mentions that given the factors of selection, compass accuracy, and measurement techniques, a certain amount of error is expected, and that many flagrant errors were usually adjusted during resurvey. While some error may not have affected the usefulness of the data, he points out that it is "not whether bias was present, but whether it was important" (Bourdo 1956:761).

The original surveys of Alcona, Iosco, Ogemaw, and Oscoda Counties were undertaken from 1837 to 1846. A comparative check of natural features on GLO survey plats was consistent with respect to the same features on current versions of the USGS quadrangle sheets. Results of tests for bias performed by Bourdo (1956), Bushen, et al. (1966), and Jones and Kapp (1972) on GLO survey data for various northern Michigan counties, including Bay County north of Saginaw, proved insignificant. In light of these results and the fact that the surveys in the Au Sable River study area were carried out consistently by the same individuals, it is presumed that these data also display minimum bias and are suitable for reconstructing vegetation boundaries in the study area.

The following methods were used in preparing Figure 4, a map of the presettlement forest along the Au Sable River study area. Individual bearing tree species, line species, and topographic
features were plotted on a one inch to the mile (1 cm : 1.6 km) base map. Dominant tree species were also color-coded to enhance the boundaries between hardwood and conifer groups. Using methods described by Kapp (1978), forest-type boundaries were established by incorporating the percentages of dominant species in each section with the surveyor's written notations regarding timberland, swampland, and topography. Where applicable, descriptions of forest composition were integrated with those of existing northern conifer-hardwood forest patterns which have been postulated by Brewer (n.d.), Brown and Curtis (1952), and Kapp (1978).

Within the study area eight timber associations have been recognized and are summarized below:

1. Mixed pine forests outnumbered all other forest associations recorded in the study area. Red pine predominated, occurring in quantities from 15-50%. Other species included jack pine (10-40%); white pine (10-30%); white birch, aspen, spruce, white oak (20%); and occasionally elm and maple.

2. Northern hardwood forests contained strong components of American beech (to 60%) and hemlock (to 50%). Sugar maple was widely variable and scattered in amounts less than 40%, as were red pine and white pine. Variable amounts of black oak, basswood and birch aggregated about 15%.

3. The jack pine plains consisted of 50-100% jack pine. Red pine was variable and scattered (10-30%), while oak and aspen reached 20%. White pine constituted <10% of the association. It is
Figure 4. Presettlement forest and logging site distribution along the Au Sable River.
interesting to note that in one township nearly 85% of the land surface was covered by jack pine, or spruce pine, as it was called by the early surveyors.

4. Mixed pine-hardwood associations tended to border the northern hardwoods. Red pine (20-50%) and somewhat less white pine dominated, with jack pine appearing in more variable quantities. The beech-hemlock association commonly reached 30%, but sugar maple was much more variable. Other species present included black oak, basswood, aspen, maple, and white birch.

5. Red pine forests were dominated by 60% or more red pine, but also contained white pine (10-30%) and variable and scattered stands (to 15%) of jack pine, aspen, black oak, and spruce.

6. Oak-aspen-pine associations were present in the stumplands and old burn areas. When witness trees were available, aspen predominated in quantities up to 30%. Consistent percentages (10-20%) of white pine, red pine, jack pine, white oak, and black oak were also noted.

7. Cedar swamps, the most abundant swamp forest type, were found in low wet areas and along drainages. Cedar predominated (from 20-75%), while tamarack and black ash reached 20%. Spruce, balsam fir, white birch, and a very little elm comprised subdominates.

8. A small number of tamarack swamps were scattered, usually along the Au Sable River. Tamarack reached 40%, while balsam fir and black ash were noted in smaller quantities.
The use of presettlement forest data from GLO survey field notes offers new insights about the forest the lumbermen knew which might benefit logging site locational analysis. In the aftermath of the lumber industry, many areas reverted to earlier stages of forest succession, while others were artificially planted or taken over by previously minor timber species. For example, LTA's 8 and 9 on the Huron National Forest today support mixed stands of black oak, white oak, aspen, red pine, white pine, and red maple on the dry sand hills where vast expanses of mature red and white pine once flourished. Bourdo (1983:14) notes that frequent wildfires following in the wake of logging perpetuated the initial destruction by killing young seedlings, and in some areas, by rendering much of the soil sterile.

Elsewhere in northern Michigan, red oak is reportedly more plentiful now than it was during the original land surveys. Preliminary findings suggest to Brewer (n.d.) that the development of modern forest management practices may have aided the establishment of red oak within the old frequently burned cutovers. Considering this, it should be mentioned that only one red oak was recorded in the entire study area by the early surveyors. For these reasons and the fact that the mechanisms of succession which created the early forests have continued since the onslaught of the early lumber industry, judicious use of the GLO notes may present the most accurate rendering of the presettlement forest cover.
Field Methodology

The 18 logging-related sites used for this analysis were recorded in 1978, 1980, and 1981 during field surveys conducted prior to various land alteration projects, usually timber sales or planting activities. Despite USDA Forest Service goals and statewide research strategies, among the realities of working within federally mandated cultural resource programs is the fact that surveyors often have little choice about survey locales. Interpretive descriptions and management recommendations for each site are summarized at the end of this chapter and within the Huron-Manistee National Forests Cultural Resources Reports No. 1 (Brashler and Davis 1980) and No. 2 (Davis, In press).

By 1983, it was estimated that perhaps only 10% of the 324-square-mile (829 km²) study area had actually been surveyed (Davis, pers. comm., 1983). These 18 logging sites constitute a rather small nonrandom sample within a universe which may contain as many as 200 logging sites based on present site densities. Figure 4 illustrates logging site distribution in the study area.

Field survey strategies have been systematic throughout the inventory program. Prior to each field season, pertinent background data were assembled in project packets. Included were notes from previous reconnaissance, topographic maps, aerial photographs, and known cultural and environmental data. Each proposed undertaking, whether it be a timber sale or planting, was also evaluated for its
potential impact on any prehistoric and historic cultural resources which might lie within or adjacent to the project boundaries.

Reflecting prior knowledge, projected impacts, and daily field conditions, systematic pedestrian survey was used to cover from 50-100% of each project area. More intensive coverage was prescribed for projects of greater expected impacts, e.g., clearcuts as opposed to selective cuts or hardwood thinnings. Survey crews ranged from 3-4 undergraduate and graduate archaeology students. Occasionally, surveyors were also accompanied by Forest Service District personnel. The 30-meter interval established for walkover coverage varied only slightly, depending upon the surface visibility and the ability of surveyors to keep in sight of one another within the understory vegetation. Shovel tests for subsurface prehistoric cultural remains were placed at 30-meter intervals within 100 meters of major riparian features or water bodies of 10 acres or more in size (Brashler and Davis 1980).

Information regarding certain patterns observed in the location of historic sites during earlier forest surveys was incorporated into the research design. Frequently, the severe impact of forest fires, storms, frost, or human activities on the landscape alters nearby vegetation and soil conditions sufficiently to create an opening with the forest canopy. Such clearings are often slow to regenerate, sometimes taking several decades. Moreover, as noted by Ahlgren and Ahlgren (1983), volunteer plant species such as aspen, white birch, grasses, and raspberry are the first to invade disturbed areas — and
abandoned cultural sites — thus establishing a vegetational anomaly within otherwise homogeneous timber. Often visible in aerial photographs and on Forest Service timber compartment maps, these clearings and anomalous forest patterns have provided surveyors with additional clues as to the location of historic sites. A final locational pattern recognized on previous forest surveys and integrated into this survey strategy on the Huron-Manistee National Forests is the observation that historic sites are nearly always associated with transportation features. In light of this, surveyors have attempted to locate and survey all mapped or unmapped roads, two-tracks, trails, and abandoned railroad grades.

The association of historic sites with roads and their visibility on early (c. 1930's) aerial photographs has prompted some investigators to rely more heavily on these methods as a means of reducing labor intensive pedestrian coverage. However, given enough time and favorable conditions, forests may recover from the impact created by roads and clearings. Prehistoric mounds and earthworks as well as historic sites related to the eighteenth-century fur trade, the early homestead period, or the nineteenth-century lumber industry are sometimes found amidst dense vegetation rather than associated with an old clearing or apparent transportation network. To restrict field reconnaissance to obvious roads or to "ground-truthing" aerial photos may unintentionally bias the sample of archaeological sites and ultimately the cultural record. Moreover, in view of cultural resource management on national forest lands, this bias could also
result in adverse impact or obliteration of significant cultural resources.

Recognition of historic sites on the Huron National Forest, including logging camps, presents some unique problems for archaeological inventory and preliminary evaluation. The more easily observed features, such as depressions and earthen-embanked foundations comprise the majority of visible cultural features. Long untended apple trees, lilac and honeysuckle shrubs, jonquils, and other ornamentals may still grow along structure walls, fence rows, or in small abandoned orchards and garden beds. However, those site remains that are less visible are still important for initial field documentation. Remnant trails and tote roads, unbanked structural foundations, amorphous earthen features from machinery or site activities, and artifact dumps often require keen observational skills to discriminate site-related disturbance from post-occupation changes.

Probably the most unsettling field observation regarding historic sites on the Huron National Forest is their apparent lack of diagnostic surface artifacts. The salvaging of usable material from abandoned camps and homesteads has no doubt been as common in northeastern Lower Michigan as elsewhere. Also, through the years bottle collectors and relic hunters have likely discovered all but the more inaccessible sites. Of the 18 lumber industry sites under study, only 11 yielded surface artifactual remains. Two of these sites produced artifacts which could be considered diagnostic from
the standpoint of determining site function, and only one produced bottle fragments suitable for chronological estimate. Nearly all artifacts located during preliminary survey were fragmented, and many were burned. The remaining seven logging sites lacked surface artifacts. No formal artifact analysis has been attempted for any of the study sites, for without additional data, artifacts can contribute only minimally to the stated objectives of this study.

Site Descriptions

All archaeological sites, once located during field survey, were mapped and recorded using the standard USDA Forest Service Eastern Region Cultural Resource Inventory Form (R9-2300-8) and graph paper. Each site received a Forest Service site number coded to Region, Forest, and Ranger District. A State of Michigan site number was later designated. Careful notations were made regarding site size, probable site type, provenience or precise location, number and size of discernible features, and observed artifacts. A site map was then drawn to scale using either a compass and pacing or tape measure and a prominent datum, usually a section post, road intersection, or unmarketable tree. Nearby vegetation, landforms, roads, railroad grades, and water features comprising the site environs were also mapped to provide as accurate a locational picture as possible. Finally, in order to generate preliminary management recommendations, surveyors assessed the physical condition of each site, including the degree of any post-occupational disturbance by timber management.
activities, road or recreation construction, erosion, relic seekers, or other developments. Comments regarding site potential for regional, problem-oriented, or thematic research, and for National Register of Historic Places eligibility concluded the documentation process.

The following descriptions summarize data from the 18 historic sites selected for locational analysis in Chapter Five.

T. 24 N., R. 3 E.

1. Deerslayer #1 Site (FS 09-04-05-35; 200G18) is an extensive probable logging encampment containing at least 16 earthen embanked structural features and depressions which range in size from 1 x 1 m to 16 x 22 m. Built along a low ridge about 20 m east of a small inland pond, this site covers an area of nearly 10,200 m² (1.02 ha). Trails or early tote roads, nearly invisible in the underbrush, still wind within the site perimeter, and an abandoned railroad grade runs generally east-west some 55 m to the south. Numerous grades and tote roads follow the nearby ridges and valleys. A few bottle glass fragments, a barrel hoop, and a hammered and resharpened shovel blade constitute the only observable artifacts at this undisturbed site. Deerslayer #1 lies within LTA 10, an area of rolling morainal uplands and poorly drained wet areas. The presettlement forest, which was dominated by red pine and white pine, also contained moderate quantities of beech, hemlock, sugar maple, aspen and white birch.
2. Deerslayer #2 Site (FS 09-04-04-39; 200G17) is also located within LTA 10, rolling morainal uplands and poorly drained wet areas. Presettlement timber consisted of red pine and white pine with moderate and variable amounts of jack pine, beech, hemlock, sugar maple, aspen, and white birch. Situated about 20 m from the edge of a small inland pond, this site lies approximately 350 m east of Deerslayer #1 Site (05-35). The High Grade Site (FS 09-04-05-40) is located some 580 m northwest of Deerslayer #2 and is situated along the same railroad grade that passes south of it.

Three earthen embanked structural features are visible within an area of 800 m$^2$ (.08 ha). Two of these are built into the hill on the east and share a common embankment. Bottle and window glass fragments, some heat melted, are exposed on the surface. Connecting this site to the railroad grade some 45 m to the south is a remnant tote road which also continues north past the site and along the pond to a point where it meets a terminating railroad spur. Apart from some surface scarification on the tote road to the south, the site is undisturbed. Based on field survey, Deerslayer #1, Deerslayer #2, and the High Grade Site appear to be three functionally discrete and undisturbed railroad logging sites situated within 800 m of each other. Likely suitable for thematic study, protection and further evaluation are strongly recommended.
3. The Apple Grove Site (FS 09-04-06-37; 200G16) is a large historic site located within an area of level to gently rolling morainal hills. The surrounding presettlement timber consisted of northern hardwoods, primarily American beech, hemlock, and sugar maple. Moderate quantities of red pine and white pine were also present. The site is bisected by an east-west trending railroad grade which is now used as a two-track and which intersects a gravelled Forest Service road about 75 m to the east. A second railroad grade flanked by well-formed Swede holes branches off in a northwesterly direction from the aforementioned grade/two-track.

Covering an area of about 30,000 m² (3 ha), the site contains at least two slightly embanked structural features, four depressions, one 3-3.7 m deep well, and two probable well depressions or water reservoirs located within the small swampy pond on the north edge of the site. Two mature domestic apple trees grow in a small shrubby opening roughly centered within the site perimeter. The scatter of white earthenware, window and bottle glass, chimney glass, and utility earthenware observed in the two-track was very fragmented. Machine cut square nails, railroad spikes, and an iron coupling piece were also noted. The structural diversity and good condition of this site argue for further evaluation by means of archival search and possibly test excavation.
4. Logger's Rest Site (FS 09-04-06-44) consists of two embanked structural features and one circular depression within a 1200 m² (.12 ha) area at the base of a hill and along the edge of a cedar swamp. The Au Sable River crosses these lowland sand plains (LTA 13) about 610 m to the east. The presettlement forest was composed of mixed red pine, jack pine, white pine, and cedar swamp species. Bisecting this site is an overgrown logging road which has been corduroyed through swampy terrain. This road follows the base of a northeast-southwest trending ridge and passes the Turkeyfoot Site (FS 09-04-06-43) some 750 m to the southwest. Recent trail bike disturbance along the corduroy road has revealed a light scatter of white earthenware, bottle glass, and metal. A wire nail was observed within one foundation.

Logger's Rest is one of the few recorded sites located close to the Au Sable River. Its proximity to the river and to the nearby Turkeyfoot Site (06-43), another probable logging camp, poses the opportunity for thematic research of pine era logging. The high, sandy, and eroded banks and wide grassy flats bordering the Au Sable River to the east suggest that further survey may locate additional evidence of early logging activity in this area.

5. The Turkeyfoot Site (FS 09-04-06-43) covers an area of 900 m² and contains one embanked foundation and seven depressions. It is situated on a level sandy ridge above a large cedar swamp in LTA 13.
An overgrown tote road traverses the hillside from the site to the aforementioned corduroy road below. Following the edge of the swamp, this remnant logging road leads out onto the flats above the Au Sable River about 1.6 km northeast of the site. Red pine, jack pine, and white pine predominated the presettlement timber, with white birch, aspen spruce, and white oak occurring in lesser quantities.

Without further study and archival research, site age and significance remain vague. While some artifacts are usually observed in similar multi-feature sites, none were found here. The presence of a gravelled road adjacent to the site on the west has likely encouraged collector visits over the years. Road improvements and a red pine plantation to the north may also have encroached on the original site limits. Like Logger's Rest (06-44), Turkeyfoot is one of the few recorded sites located close to the Au Sable River. Though lacking surface artifacts and prominent features, its location and associated logging road add diversity to the site data under consideration.

T. 25 N., R. 3 E.

6. The Siding Site (FS 09-04-05-22; 200D13) lies within an area of dissected outwash sand plains in LTA 4. The nearest permanent surface water is Mack Lake, more than 3.2 km southwest of the site. The original forest, as described by GLO surveyors, was predominantly jack pine, although some dwarf oak was also scattered throughout.
Six structural depressions and two narrow trenches comprise the site which, including a small opening, covers about 1200 m² (.12 ha). Some 20 m to the west and running north-south of the site is a prominent railroad grade with deep Swede holes on either side. A second grade, adjacent to the first, forms a railroad siding. Inasmuch as the only visible surface artifacts were four barrel rims, dating this site poses problems for preliminary evaluation. However, its apparent good preservation and clear railroad association warrant further study and possible inclusion in logging research.

7. The High Grade Site (FS 09-04-05-40) may be a unique remnant of the logging era. Straddling a railroad grade cut through rolling and sandy morainal hills (LTA 8), this site was once situated within stands of red pine and white pine at the edge of the hardwood forest and near the interface of the jack pine plains. It consists of about six pairs of shallow trenches distributed over an east-west trending ridge for a distance of approximately 85 m. Trench pairs are of equal size and perpendicular to the railroad grade nearly 2 m below. One depression is situated between two pairs of trenches. No additional cultural disturbance or artifacts were observed.

Immediately west of the site the grade has been built across a natural kettle depression, and some 340 m further on it intersects another grade. East of the site the grade bends to the south then west before passing about 45 m south of the Deerslayer #2 Site (05-39). While the function of High Grade is unknown, the site may have been used as a loading facility for log transport. Such a site
is unusual in the Michigan site record and begs further study. Moreover, the close proximity of both the Deerslayer #2 Site and the very large Deerslayer #1 Site (05-35) offers an excellent opportunity for research on intersite function.

8. The Afterall McGraw Site (FS 09-04-05-40) occupies a narrow ridge within LTA 10, rolling morainal terrain, about 85 m north of a 1.6 ha natural lake. The presettlement timber consisted of mixed pine and hardwoods, primarily red pine and white pine with variable quantities of beech, hemlock, and sugar maple.

Covering an area of approximately 2800m² (.28ha), this probable logging camp contains a grouping of three embanked foundations with one trench-like depression situated some 25 m away. The site appears to be completely undisturbed, and a number of artifacts were observed including cast iron stove parts, tin can fragments, baling wire, leather boot soles with brass screws, and bottle glass. Fragments of a light blue embossed and paneled bottle found during routine shovel testing along the ridge may date from about 1860-1915 (Newman 1970:74). Leading east from the site is an abandoned tote road which follows the ridge before disappearing in the timber. Prominent railroad grades abound throughout the valleys in the area. One grade enters the marshy drainage at the west end of the lake and becomes inundated. The inaccessible location and excellent condition of the Afterall McGraw Site enhance its potential to contribute to logging research and argue strongly for its protection from adverse impacts.
T. 25 N., R. 4 E.

9. The Barrel Creek Site (FS 09-04-07-46) lies at the edge of a 1500m² (.15 ha) clearing within LTA 8, an area of dry and sandy morainal hills. Red pine and white pine dominated the presettlement timber, but moderate amounts of beech, hemlock, sugar maple, basswood, oak, and aspen were also present. Two structural features remain, an embanked foundation and a circular depression. A wooden barrel, the only artifact observed, is partially buried in a shallow stream about 40 m northeast of the site. A railroad spur bisects the site clearing then intersects the same grade which passes the Reames Terrace Site (07-43) and the Lilley Terrace Site (07-44) about 1.6 km to the south. Because of its closely associated railroad, a logging function is presumed for this site pending the results of further evaluation and archival research.

10. Situated at the southwest edge of a 9 ha marsh, the Reames Terrace Site (FS 09-04-07-43) is a large railroad-associated logging camp. Within the surrounding dry, sandy morainal hills (LTA 8), GLO surveyors noted a predominance of American beech, hemlock, and sugar maple with varying quantities of red pine, white pine, basswood, black oak, and birch.

At least eight earthen embanked foundations, 12 depressions or groups of depressions, a large dump, a garden remnant, and numerous site-related surface irregularities comprise this complex 18,000m² (1.8 ha) site. The large dump, recently exposed by an emergency fire trench, produced a plethora of artifacts common to logging.
operations. Artifacts representing several aspects of camp activities include household items, large butchered mammal bones, bottle glass, white earthenware, a rubber boot or shoe sole, charred wood, burnt glass, window glass; and "smithy" debris, such as horseshoes, shoeing nails, chain links, cinders, hinges, and barrel hoops. Preliminary estimates suggest a late nineteenth-century occupation, but further evaluation is required.

Railroad grades and numerous spurs wind throughout the surrounding hills. At least one nearby spur terminates in the hillside. Approximately 460 m northeast of the Reames Terrace Site is the Lilley Terrace Site (07-44), another probable logging encampment. The relationship between these two large sites and/or between these sites and the Barrel Creek Site (07-46) to the north, is unknown. Protection is recommended pending additional research.

11. Lilley Terrace (FS 09-04-07-44) is situated at the northeastern edge of the same large marsh. Although the site rests in a level area, the surrounding rolling terrain is within LTA 8, dry sand hills and moraines. The presettlement forest consisted of beech/hemlock/northern hardwoods with some red pine and white pine. A large number of structural depressions and earthen embanked features comprise this site which has yet to be field mapped. No artifacts were observed during preliminary survey. Railroad grades and tote roads lace the surrounding area. A prominent grade, now a two-track, forms a solid earthen dam as it crosses the eastern edge
of the marsh. Wooden trestle pilings are still visible in the shallow waters on the west side of this grade.

12. Lumberman's Junction (FS 09-04-07-39; 200D23) consists of a single structural depression within a network of railroad grades and spur lines. The surrounding morainal hills (LTA 11) were originally covered with beech/hemlock/northern hardwoods, although red pine and white pine were also present in moderate quantities. The adjacent railroad grade intersects at least three other grades or spurs about 155 m southeast of the depression. Numerous Swede holes are present along the grades, but no artifacts or additional cultural features were observed. Chronological estimates are impossible for Lumberman's Junction without additional research. Since the number of intersecting railroad grades argues strongly for a logging activity area, this site might be significant for lumber industry studies.

T. 25 N., R. 5 E.

13. Perched on a south-facing slope above and about 600 m east of Bamfield Creek, the Bamfield Site (FS 09-04-07-53) is located within LTA 12, low morainal hills pitted with poorly drained depressions. Presettlement timber was described as a mixed composition of red pine and white pine with moderate quantities of beech, hemlock, sugar maple, black oak, basswood, white birch, and aspen. An old tote road/two-track winds uphill to the site from the gravelled Forest Service road which now follows the drainage. A railroad grade parallels the north edge of this road. Three
structural depressions were recorded, each built into the hillside and banked with back dirt. The site covers an area of about 1200m² (.12 ha). No artifacts were observed.

T. 26 N., R. 4 E.

14. The Old Stove Site (FS 09-04-07-04; 200D03) lies approximately 3.2 km south of the Au Sable River within LTA 10, an area of gently rolling moraines. Mixed red pine, jack pine, and white pine dominated the original forest. Site area is about 400m². One embanked structural foundation is the only visible feature. Although an iron cook stove and kettle are present on the surface, neither is especially diagnostic for chronological estimates. Part of a former railroad grade, now a gravelled road, trends northeasterly some 396 m to the south of the site and might also be associated. However, considering the lack of diagnostic remains, further evaluation is recommended to better confirm site identity and function.

T. 26 N., R. 6 E.

15. A single depression constitutes the Divot Site (FS 09-04-07-48) which is located about 6.5 m east of an overgrown logging road and 60 m south of an abandoned railroad grade. A low wet area, flooded by beaver activity, is situated approximately 40 m to the east. The surrounding terrain identified as LTA 5, rolling and pitted outwash sand plains, originally supported a red pine forest.
Covering an area of about 10 m², this site lacks artifacts or additional features. Chronological estimates are impossible to assign. Its probable railroad and tote road associations suggest a logging-related function. Further evaluation is recommended.

16. Covering an area of approximately 51,000 m² (5.1 ha), the Apple Hollow Site (FS 09-04-07-47) is a large logging camp located at the south edge of a huckleberry marsh and just west of a beaver-flooded pond. At least three earthen embanked foundations and two depressions remain along the high ground. In addition, two probable well depressions or water reservoirs have been excavated into the bank of the huckleberry marsh. All of the features are situated in an area of dense underbrush, and additional features may be present. Five cultivated apple trees are growing in a small weedy clearing some 400 m south of the marsh. Finally, a railroad grade remnant passes east of the site and along the west edge of the beaver pond where it apparently has been inundated.

The site is situated within LTA 8, an area of sandy morainal hills. Red pine predominated the presettlement timber. At the time of the original land surveys, the forest, for a distance of 800 m to the south, had been burned over. The Apple Hollow Site is a large and undisturbed logging encampment which exhibits excellent research potential. However, without test excavation and datable artifacts, archival study may be the only means to better establish research potential or National Register eligibility.
17. The Poplar Lake Site (FS 09-04-07-35; 20AA48) is a probable logging camp located in an area of rolling and pitted outwash sand plains (LTA 5). The nearest surface water is a small inland pond about 305 m to the southwest. The surveyor's notes described the surrounding forest as predominantly mixed red pine and jack pine with variable quantities of white pine and black oak. At the time of the survey, fires had swept much of the land for a distance of 800 m to the south of the site.

This site consists of two slightly embanked features within an opening of approximately 1200 m² (.12 ha). No artifacts were observed. A remnant trail or tote road leads from the site to a point about 50 m to the north where it meets a Forest Service road. This gravelled road, unlike section line roads, follows the ridges and contours of the surrounding hills. Although the age and function of this site are undetermined, its location, embanked features, and layout are very similar to documented logging camps. Further evaluation and archival research are recommended to better assess its potential significance.

18. Hawk Watch (FS 09-04-07-52; 20AA43) consists of three earthen embanked foundations, one depression, a domestic dump, and related surface disturbance or features. The site is situated on two level terraces above a stream confluence and huckleberry marsh immediately to the south. The walls of the embanked features are built into the upper terrace to compensate for slope and perhaps to
utilize a "natural foundation." Artifacts observed in the small dump include white earthenware, bottle glass, fruit jar fragments, and metal.

The site covers an area of 2800m$^2$ (.28 ha) within LTA 14, low valley plains. Presettlement forest was described as red pine, white pine, and jack pine with scattered white birch, spruce, aspen, and white oak. While several two-tracks winding through the nearby hills are not irrefutable logging roads, the railroad grade which follows the north edge of the Bamfield Creek drainage is most certainly a logging remnant. In addition, at the south end of the site a graded and gravelly land spit drops sharply into the marsh. This site is tentatively considered to be the same as the farm or homestead site (FS 09-04-07-22; 20AA43) described by a local informant to Forest Service personnel. However, the site had not been confirmed or field mapped until the 1981 cultural resource survey. Based on the adjacent railroad grade, site layout, structural embankments, and large area of site-related disturbance, a logging camp function is suggested. The fact that a reliable informant remembers this site as a farm poses questions about possible site reuse. Archival research and test excavation may help clarify site function and date of occupation.
CHAPTER V

ANALYSIS

In this chapter, data from 18 lumber industry sites are analyzed with respect to the chronology in Hypothesis 1 and to Hypotheses 2, 3, and 4 which have been generated from the historical model and outlined at the end of Chapter Three. The results are compared with those of similar analyses undertaken for lumber industry sites in Michigan's Upper Peninsula. Summary comments incorporate selected site-specific documentation which has been obtained through a preliminary records search.

Building Logging Camps

Hypothesis 2: Logging Camp Structure

The historical model implies that increases in logging camp size, i.e., the number and dimensions of structures, are proportional to developmental changes in logging methods and technology, especially the advent of steam-powered railroad logging (Table 3). This would suggest that since the railroad was not introduced in the Au Sable River basin until around 1883 (see Table 2), railroad-associated sites in this area should contain more than six structures. On the other hand, possible river drive associated logging sites, those sites which lack railroad grades and which are situated within a 7.2 km nonmechanical sled haul of a driveable stream, should contain less than six structural features.

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Field evidence for the type of major transportation utilized at the 18 logging industry sites in the Huron National Forest sample indicates that 13 sites situated within 200 m of a railroad grade are likely railroad associated, and one located nearly 40 m away may also be railroad associated. Three sites which lack evidence of a railroad grade may have used the river drive as major transportation. A final site which abuts a major water feature, a railroad spur, and a probable banking grounds presumably would have used the less expensive river drive for major transportation and the railroad for short hauls. The dearth of non-railroad associated sites is thought to reflect their small numbers in the early years of lumbering and poor surface visibility in absence of the more prominent railroad grades.

For this analysis, only the indisputable earthen-embanked foundations are counted as evidence of occupational structures, i.e., cook shacks, bunk shanties, barns, etc. Among the lumber industry sites under consideration, nine railroad-associated sites contain a mean number of 3.8 embanked structural features (Mean = 3.8, SD = 2.9), while four non-railroad associated sites contain the mean number of two foundations (Mean = 2, SD = .82). These results might support the contention that non-railroad, possible river drive-associated camps are smaller than railroad-associated sites. However, the size of railroad sites appears to be much more variable, as illustrated by the range of 1-10 embanked structures for nine sites. In light of the very problematical lack of diagnostic surface
artifacts on Huron National Forest sites, a more consistent relationship between site size and transportation technology might permit the assignment of relative occupation dates. Later results pending, those sites in this sample which are located within 200 meters of a railroad grade, regardless of the number of embanked structures, are tentatively thought to date from after 1883.

If the logging railroad era brought with it larger camps, as is suggested by the historical model, comparisons of structure size may also reflect increases which are proportional to the larger camp crews and/or to the replacement of log structures by board and tar paper camps. The mean size of a total of eight embanked structures at four non-railroad associated sites is 29 m², (SD = 2 m), while the mean size of 32 embanked foundations at nine railroad-associated sites is 79 m², (SD = 87 m²). Although the sample of structures at railroad-associated sites reflects a larger more variable site sample, mean structure size does appear to be considerably greater at the railroad sites. However, these figures also raise some doubts regarding the value of this measurement. Preliminary comparisons with the historical literature suggest that changes in structure size may not be a reliable indicator of relative site age. For example, mean structure size at an 1870-1871 camp and at a late 1880's camp, 155 m² (SD = 112 m²) and 189 m² (SD = 32 m²) respectively, are both much greater than the mean structure size for all logging sites in the Huron National Forest sample (Fitzmaurice 1979:22; Saginaw Daily Courier 1871b:2). One wonders whether local custom and the use of
standard log lengths more aptly governed structure sizes, at least until log structures were replaced by board and tar paper buildings.

Despite ambiguous results regarding structure size, the trends in camp size tend to follow those found in similar studies in Michigan's Upper Peninsula, albeit within a later chronological framework. In a sample of 83 datable late nineteenth-century and early twentieth-century camps on the Hiawatha National Forest, CAI investigators (1984:154) have found that mean site size measured by decade, appears to increase in the twentieth century. Using a much smaller sample of 10 datable logging sites on the Ottawa National Forest in the western Upper Peninsula, Franzen and Dinsmore (1983:17) have looked for an increase in camp size to coincide with the introduction of the narrow-gauge logging railroad, or after about 1910 in this region. Five pine era logging camps, which lack railroad association and which have been dated by artifact analysis to before 1910, display a mean of 4.75 structures, more than twice the size of non-railroad sites on the Huron National Forest. Five post-1910 railroad associated logging camps contain a mean of 11.2 structures (Franzen and Dinsmore 1983:113). Compared to the mean of 3.8 structures noted for Huron National Forest railroad associated sites, similar sites on the Ottawa are almost three times larger.

Such large discrepancies in site size may be attributable to the more advanced technological time frame and especially to the larger, more fully developed corporate structure of the lumber industry in the Upper Peninsula. Variability in the size of railroad associated
lumber industry sites in both regions may also indicate the use of smaller, single purpose camps such as jobber camps, road construction and maintenance camps, or even the separate "train men and teamster camps" as described by Ellis (1975:46). Nonetheless, in both Upper and Lower Michigan, non-railroad associated logging sites are smaller than railroad sites, consistently containing less than six embanked structures.

Hypothesis 3: Timber Associations

As described in the historical model, nonmechanized pine logging/river drive operations required a centralized site location within the timber tract which was no more than 2.4 km by foot from the cutting area. Rules for the later, more mobile railroad logging operations were less stringent, permitting distances of up to 4.8-8 km between camp and work. The logging railroad promoted access to the more remote stands of red pine and white pine, to many hardwood species marketable around 1890 (see Table 2), and shortly after 1900, to the jack pine plains for pulpwood. It has been hypothesized that the narrow-gauge railroad enabled logging camps to be located either within stands of mixed pine and hardwood timber or along the margins of the northern hardwood tracts and pinelands.

Although all of the sites are well scattered over several morainal and outwash landforms, five railroad associated sites fall within LTA-8, dry and sandy morainal hills, and four railroad associated sites cluster in LTA-10, rolling and pitted morainal hills
with clayey and silty soil (see Table 4 and Appendix B). The
distribution of sites within the presettlement forest is also
somewhat variable, as shown in Table 4. All four non-railroad
associated sites are located within a mixed pine or a mixed pine and
swamp forest, while among railroad associated sites, four are located
in the northern hardwoods, five are in mixed pine-hardwood timber,
four are situated in pine timber, and one is beset by the formidable
jack pine plains.

In a preliminary timber-catchment exercise patterned after Roper
(1979), each probable logging camp (i.e., any site containing one or
more embanked foundations in which loggers may have lived), has been
circled by a "camp to work distance" respective to its apparent
transportation mode. As previously stated, this distance is 2.4 km
for non-railroad associated sites and up to 8 km for railroad
sites. Each superimposed circle encloses the maximum area from which
nineteenth- and early twentieth-century loggers might have harvested
timber if not contained by property boundaries, rights of way, etc.
This timber-catchment zone encompasses 18 km² for non-railroad
associated sites, while logging activities at railroad sites may have
covered an area of 201 km². Percentage calculations of the dominate
presettlement forest groups within each timber-catchment area
indicate the range of timber types available to the kind of logging
operation at each site. Figure 5 illustrates two timber-catchment
areas for the Hawk Watch Site (07-52), a pine timber camp which
contains both a closely-associated railroad grade and a major stream.
Table 4
Summary of Locational Data for Eighteen Lumber Industry Sites on the Huron National Forest

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<td>Railroad</td>
<td>60</td>
<td>8</td>
<td>Pine-hardwoods</td>
</tr>
<tr>
<td>07-53</td>
<td>Railroad</td>
<td>140</td>
<td>12</td>
<td>Pine-hardwoods</td>
</tr>
<tr>
<td>05-40</td>
<td>Railroad</td>
<td>0</td>
<td>8</td>
<td>Mixed pine</td>
</tr>
<tr>
<td>07-04</td>
<td>Railroad</td>
<td>396</td>
<td>10</td>
<td>Mixed pine</td>
</tr>
<tr>
<td>07-47</td>
<td>Railroad</td>
<td>140</td>
<td>8</td>
<td>Red pine</td>
</tr>
<tr>
<td>07-48</td>
<td>Railroad</td>
<td>6.5</td>
<td>5</td>
<td>Red pine</td>
</tr>
<tr>
<td>05-22</td>
<td>Railroad</td>
<td>20</td>
<td>4</td>
<td>Jack pine plains</td>
</tr>
<tr>
<td>07-35</td>
<td>River</td>
<td>7200</td>
<td>5</td>
<td>Mixed pine</td>
</tr>
<tr>
<td>06-43</td>
<td>River</td>
<td>1600</td>
<td>13</td>
<td>Mixed pine</td>
</tr>
<tr>
<td>06-44</td>
<td>River</td>
<td>610</td>
<td>13</td>
<td>Mixed pine/swamp</td>
</tr>
<tr>
<td>07-52</td>
<td>River</td>
<td>150</td>
<td>14</td>
<td>Mixed pine</td>
</tr>
</tbody>
</table>

Note. Distance to the nearest probable major transportation feature is measured from the center of each site.
The findings are summarized in Table 5. This table compares the presettlement forest type in which each site is located with the percentages of forest types available to the loggers within the 2.4 km and 8.0 km radii of the camps.

The catchment area for the three non-railroad associated sites, all of which are situated within pine forests, includes over 50% pine timber and no hardwood groups. These figures appear to support expectations for these sites. However, three camps associated with railroad grades and located in the northern hardwoods are surrounded by an available timber catchment which is not only comprised of 50-70% hardwoods but also as much as 20-30% pine-dominated forest types. The moderate amount of pine most likely reflects those sites which are situated close to the margins between pine- and pine-hardwood-dominated forest groups.

Three pine timber camps which are associated with railroad grades also contain large amounts of pine (over 50%), although these results may have been skewed by data from the area surrounding the one jack pine plains camp which consists of 89% jack pine. Presumably, the one pine timber site which is associated with both river and railroad transportation may also have extracted timber from both catchment zones. As indicated in Table 5, the presettlement forest composition around this site varies little between the smaller and the larger areas and includes a variety of timber types. Presettlement forest environs for the five camps located in pine-hardwood timber are similarly diverse. All in all, the larger
Figure 5. Presettlement timber-catchment area for the Hawk Watch Site, 07-52.
Table 5

Relationships Between Site Location and the Presettlement Timber-Catchment Area

<table>
<thead>
<tr>
<th>Location</th>
<th>Percent of Forests Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pine</td>
</tr>
<tr>
<td>Non-railroad associated</td>
<td></td>
</tr>
<tr>
<td>Pine (3)</td>
<td>55-80</td>
</tr>
<tr>
<td>Railroad and river associated</td>
<td></td>
</tr>
<tr>
<td>Pine (1)</td>
<td>43/45</td>
</tr>
<tr>
<td>Railroad associated</td>
<td></td>
</tr>
<tr>
<td>Pine (3)</td>
<td>60-90</td>
</tr>
<tr>
<td>Hardwood (3)</td>
<td>20-30</td>
</tr>
<tr>
<td>Pine-Hardwood (5)</td>
<td>35-70</td>
</tr>
</tbody>
</table>

Note. The timber-catchment area for non-railroad associated sites is 18 km² and 201 km² for railroad associated sites.

*Numbers in parentheses indicate the number of sites located in that forest type and transportation group.
catchment areas associated with the railroads not only enabled hardwood logging, but in the Au Sable River basin may also have increased the loggers' access to substantial amounts of pine timber.

Woods Work and Log Transportation

Hypothesis 4: Woods Work and Log Transportation

The final hypothesis addresses two forms of minor transportation, the winter sled haul on hard-packed ice roads and the use of the logging railroad over a network of spur lines.

The historical model suggests that pine era logging camps were usually situated equidistant between the cutting area and the landing where the logs were decked for a horse- or oxen-drawn sled haul of up to 7.2 km. This distance, plus a maximum camp-to-work walk of 2.4 km, implies that pine era logging camps might be located as far as 9.6 km from a driveable stream. It has been hypothesized that sites which lack direct railroad association and which are situated up to 9.6 km from a major water feature may have been winter camps built to cut pine, cedar, and possibly hemlock. The three non-railroad associated sites in the sample are located within a rather widely variable mean distance of 3.1 km (SD = 3.7 km) from the Au Sable River or a prominent tributary. This large standard deviation which likely reflects the small site sample, does not appear to support the hypothesis at this level of statistical description. However, each site is completely surrounded by presettlement timber suitable for river drive transportation, e.g., red pine, white pine,
and cedar. One site, the center of which is 150 meters from both a major tributary stream and a terminal railroad grade, is also situated within a large area of red pine and white pine timber. By comparison, eight railroad associated camps located within presettlement stands of pine or mixed pine-hardwood timber are located a mean distance of 9.2 km (SD = 6 km) from the nearest major water feature. Barring the very small sample of non-railroad associated pine timber sites with which to compare these results, it would appear that the use of logging railroads generally increased the length of the short haul, in some cases beyond the maximum nonmechanized sled haul distance.

Comparisons of short haul distances using larger samples of Michigan logging camps are lacking or inconclusive. For five c. 1879-1910 (pre-logging railroad) pine forest associated camps on the Ottawa National Forest, the mean distance from the site to a major water feature is 1.06 miles (1.7 km), while five post-1910 railroad associated logging camps are located no further than 1.66 miles (2.7 km) from major water (Franzen and Dinsmore 1983:113). Commonwealth Associates, Inc. (1982:145) reports that of 31 logging industry sites on the Hiawatha National Forest, five pre-1900 logging camps are situated within 0-2 miles (3.2 km) of a major river, while the remaining post-1900 sites are located up to 5 miles (8 km) away. Neither example implies strong locational patterns for railroad associated sites. Furthermore, as with the Huron National Forest study sample, unequivocal examples of datable non-railroad associated
pine era logging sites in the Upper Peninsula also remain painfully scarce in the archaeological record. Findings from both analyses support the expected increases in camp to river distances over time, and even suggest a slight decrease after 1900 as loggers returned to clean up cutover lands (CAI 1984:150-151, Fig. 7B). However, the uncertain relationship between railroad associated sites and their locations suggests that logging industry variables selected for locational analysis may require more specific ecological data and more clearly defined expectations.

Archival Research

Documentary sources, including tax rolls, deed books, probate court proceedings and company records, may yield data pertinent to lumber industry chronology, company holdings, and changes in land value, i.e., indications of timber depletion. While the availability of these documents varies for northeastern Lower Michigan, preliminary assessments of land use records have revealed a number of relevant items which deserve mention. The first of these finds, the County Tract Books, lists the original transactions of federal lands in Michigan, including those pertinent to the Au Sable River basin lumber industry sites. They are available for inspection at the State Archives of Michigan, Lansing.

In addition, information gleaned from the Huron National Forest Land Status Record, which is on file at the Forest Supervisor's Office in Cadillac, Michigan, suggests that further discussion of
four sites in the study sample is warranted. A 330-acre (133.6 ha) tract of land on which the Deerslayer #1 Site (05-35; 200G18) and the Deerslayer #2 Site (05-39; 200G17) are located was first acquired in 1866 by an Emma A. Ripley of Saginaw County, Michigan (Huron Land Status). This same parcel, but divided into 40-acre (16.2 ha) subdivisions, was listed on a 1903 plat as belonging to N. C. and M. Hartingh (Myers and Myers 1903). Because this parcel is situated some 16 km away from the nearest major stream and within a pine-hardwood presettlement forest, the closely associated logging railroad is presumed to have been used to haul timber from the area. If the parcel was subdivided by 1903, yet today contains remnant railroad grades which crosscut these boundaries, logging may have been undertaken in the vicinity of these sites either by Ripley, the Hartinghs, or by an interim party some time after the introduction of the logging railroad around 1883, and perhaps by 1903.

Information recovered on The Siding Site (05-22; 200D13) compounds the confusion surrounding its identification and evaluation. The parcel of jack pine plains which contains this multiple-depression site, its prominent railroad grade, and curved siding apparently never left public ownership. According to the Huron National Forest Land Status Record, in 1928 this parcel was "reserved from the public domain" (Huron Land Status). Shortly thereafter the parcel became part of the Huron National Forest. Site identity remains obscure, although its immediate railroad grade runs
a veritable beeline to the active late nineteenth-century community of Potts, situated on the Au Sable River and later named McKinley. By 1891 the expansive J. E. Potts' Railroad system, a feasible owner for this long and prominent grade, contained "one line, twenty-eight miles in length, which spanned the pine plains between Potts and Damon" (Reetz 1951:24). After H. M. Loud picked up J. E. Potts' holdings in 1890 or 1891, the Potts' Railroad was renamed the Au Sable and Northwestern and operated until the Oscoda-Au Sable fire in 1911 virtually shut down the lumber industry over much of the area (MacDonald 1942:46; USDA FS n.d.:6-7). Although the main line of the Au Sable and Northwestern Railroad resumed operations for another 15 years (Powers 1912:189), the community of Damon had been declining rapidly since 1892 (Reetz 1951:45). The status of the Damon branch after the 1911 fire is uncertain. Whether this site is that of a siding-located railroad car camp or a more permanent occupation, it seems from these records that land ownership and right-of-way laws may not have posed critical obstacles on the sparsely timbered pine plains. The site's barren jack pine setting, lack of surface water, and moderate proximity (7 km) to the Au Sable River and Potts (McKinley), suggest a probable dependency on the railroad for both supplies and shipping. This association would, therefore, date the site from about 1890 to 1911, and more likely in the latter half of this period when, according to Reetz (1951:50), the jack pine plains experienced a short burst of lumbering activity.
Perhaps the most enlightening discovery in the lands records search reveals the probable ownership of the railroad and river associated Hawk Watch Site (07-52; 20AA43) on Bamfield Creek. The large parcel of red pine and white pine presettlement timber in which this site was situated was originally acquired by the State of Michigan in 1868 and then purchased for cash by Pack, Woods, & Company of Oscoda in 1885 (Tract Books). The Huron National Forest Land Status Records describe the ensuing transactions. In 1889, Pack, Woods, & Company conveyed the south half of the quarter section to a W. Lothrop while "reserving the right to all pine timber, hemlock and R. O. W. to drive logs." Another conveyance in 1896 included a similar clause, "reserving all pine, hemlock and R. O. W. to dam and flood for all such purposes and R. O. W." These conditional transactions perhaps enabled homesteaders to farm the cutovers as soon as the loggers moved on. Between the fall of 1899 and 1900 the land and its timber rights were transferred consecutively to three individuals, all of whom may have reworked the stumpland for cordwood or pulp. In 1909, presumably after all the marketable pine and hemlock had been removed, the land reverted to the state in lieu of back taxes. Under the amended Homestead Act laws of 1893, ownership of the same parcel was eventually transferred to a Mrs. J. A. Wilcox for homesteading and, after several title transfers in the 1920's, wound up in probate court proceedings in 1934 (Huron Land Status).
The Hawk Watch Site rests in a large grassy clearing on a level, well-drained stream terrace, one of the most suitable cultural site locations in the area. Future discoveries of other historic sites in this quarter section are possible, especially across Bamfield Creek where early 1938 aerial photos show one or two rectangular clearings. However, the lengthy ownership history of this parcel, including references to right-of-way conditions and log driving, suggests that the Hawk Watch Site may have been built around 1885 by Pack, Woods, & Company. After 1899 it was successively occupied perhaps by one or more homesteaders and/or by one or more small-scale loggers until reverting to the state in 1909. The 14 years of Pack, Woods, & Company ownership (1885-1899) fall largely within the transitional logging period in which the use of river drives and logging railroads was often combined (see Table 2). While the concomitant presence of a camp, a railroad grade, banking grounds, and a driveable stream is only indirectly approached by the Au Sable River model, the surrounding presettlement forest was comprised of red pine, white pine, and pine-hardwoods. The fact that a large contiguous area of prime pine timber dominated the site's theoretical 201 km² timber-catchment area appears to suggest that pine timber was available for river drive transportation within the proposed limits of nonmechanized and mechanized hauling.

One final observation deserves mention in the interest of site identification and functional classification. The High Grade Site (05-40; 200D51), comprised of one small depression and six pairs of
parallel grooves, is situated on top of a cutbank perpendicular to an
adjacent railroad grade and within mixed pine presettlement timber.
Field surveyors have tentatively identified this as a late
nineteenth- or early twentieth-century log landing and loading
site. What a satisfying moment to come upon Bryant's (1914:143)
description of a typical logging railroad skidway, or landing, as
consisting of "two continuous rows of poles placed about 8 feet apart
and extending at right angles to the track for a maximum distance of
100 feet"!
CHAPTER VI

SUMMARY AND CONCLUSIONS

The historic lumber industry model presented in this study focuses on methods of timber extraction and log transportation in an attempt to generate archaeological statements and alleviate some of the management difficulties archaeologists encounter during cultural resource survey and historic site evaluation on national forest lands in Michigan. To promote a better understanding of forest land use in the nineteenth and early twentieth centuries, the lumber industry history has been reconstructed for the Au Sable River Basin. This social and environmental history also discusses the nature of the lumber industry and the political and economic instigators precipitating its cross-country expansion.

The year 1865 marked the beginning of the pine era along the Au Sable River. Seemingly endless quantities of pine and a flourish of midwestern settlement promised a long and prosperous future. The advent of new tools, skidding devices, and especially the use of the narrow-gauge railroad for log transportation, accelerated pine production. From about 1883 to 1890 this burst of industry growth comprised a transitional period during which it was not uncommon for lumbermen to utilize both the logging railroad and the river drive to maximize their harvest. Toward the end of this period the depletion of prime pine timber led to instability within the lumber industry. Many lumbermen moved on to new pinelands. However, others turned
toward the hardwood timber with new vigor and stimulated a third stage dominated by hardwood logging and railroad transportation. This final period persisted until 1916, five years after sweeping fires ravaged the sawmill towns of Au Sable and Oscoda.

Archaeological expectations for lumber industry-related sites have been constructed from nineteenth- and twentieth-century accounts of logging and further refined by methodological descriptions of logging techniques. Cultural, technological, and environmental variables from 18 logging sites recorded on the Huron National Forest are described, analyzed, and compared with the results of similar projects undertaken in Michigan's Upper Peninsula. To address problems inherent in dating logging sites on the Huron National Forest, an attempt is made to establish relative dates based on the historical model.

The following conclusions may offer new insights about the nature of logging sites and their locations in northeastern Lower Michigan.

1. Comparisons of logging site size generally support the contention that sites which lack railroad association and which are situated close enough to a major stream to permit nonmechanical sled hauling are consistently smaller than railroad associated sites. The larger and more variable sizes of railroad sites are thought to reflect differential site function during the railroad logging period, or after about 1883, along the Au Sable River.
2. The results of a comparison of structure size between the site sample and the historical model were ambiguous and unsupportive for relative dating. It is believed that local custom and the use of standard log lengths were perhaps more influential determinants in structure size, at least until log structures were replaced by board and tar paper buildings.

3. The historical model implies that timber type and the available method of major transportation were key factors in site selection. The results of an analysis of the maximum presettlement timber-catchment areas undertaken on 15 logging camps tend to conform to archaeological expectations. Non-railroad associated camps were well surrounded by the pine timber in which they were located, while railroad associated camps, situated along the margins of northern hardwoods or within mixed pine-hardwood stands, had access to a variety of timber. The typical location of railroad associated sites within pine-dominated presettlement forest groups reflects an abundance of pine, especially red pine, and suggests that in this region the narrow-gauge railroad not only enabled hardwood logging, but facilitated the harvest of substantial amounts of pine.

4. A comparison of site location with respect to the Au Sable River or a prominent tributary suggests that short haul distances to the banking grounds for river transportation were generally increased by the use of railroad transportation. However, due to the very small sample of non-railroad associated pine timber camps, this question begs further study.
5. A review of the early land abstracts and other archival records has revealed the dates of several ownership conveyances which compare favorably with the time frame proposed for the railroad logging period along the Au Sable River. This final discussion includes an account of the transactions made for lands which contain four study area sites, and then considers the archival data in light of these sites and their earlier interpretation.

The absence of diagnostic surface artifacts imposes undue burdens on archaeologists attempting to comply with cultural resource management regulations regarding preliminary site identification and evaluation. However, it also inevitably compels the researcher to thoroughly investigate alternative sources of information such as historic accounts, archival records, and especially site context. This dependence on context further calls attention to the need for archaeological surveyors to recognize and interpret the historical landscape, including water impoundments, road and railroad networks, and other lumber industry-related activity areas. Although the results of this project have been limited by its small sample of logging sites, the basis of the historical model may be applicable to similar studies in the Great Lakes states if modified for regional differences in lumber industry chronology and corporate structure. The inclusion of datable site contexts would, of course, fill a crucial void. As a final note, although the process of reconstructing the presettlement forest of the Au Sable River study area was somewhat time consuming, it was more intriguing to envision
a hopefully accurate picture of the stretches of jack pine, red pine, and white pine, the cedar swamps, and the rolling beech-maple-hemlock forest in which the early loggers lived and worked.
## APPENDIX A

### Lumber Companies and Logging Railroads in the Au Sable River Basin Before 1920

<table>
<thead>
<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howard &amp; Van Etten</td>
<td>1836</td>
<td>Van Etten L.</td>
<td>Waterpowered sawmill; failed</td>
<td>j</td>
</tr>
<tr>
<td>Backus &amp; Brothers</td>
<td>1865-1875</td>
<td>Au Sable</td>
<td>Logged Main Branch, boomage, sawmill; sold to J. E. Potts</td>
<td>j, l, m, r</td>
</tr>
<tr>
<td>Loud, Priest &amp; Shepherd</td>
<td>1865-1867</td>
<td>Au Sable</td>
<td>2 sawmills; renamed Loud, Priest &amp; Gay</td>
<td>e, i, l</td>
</tr>
<tr>
<td>McGraw Lumber Co.</td>
<td>c. 1864-1907</td>
<td>Bay City</td>
<td>Sold to Eastman &amp; Robinson after logging pine</td>
<td>e, k</td>
</tr>
<tr>
<td>Loud, Priest &amp; Gay</td>
<td>1867-1870</td>
<td>Au Sable</td>
<td>Renamed Loud, Gay &amp; Co.</td>
<td>e, i, l</td>
</tr>
<tr>
<td>H. W. Sage</td>
<td>c. 1864-1888</td>
<td>Saginaw/Bay City</td>
<td>Logged pine s. of the Au Sable River</td>
<td>d, j, r</td>
</tr>
<tr>
<td>Smith, Kelley &amp; Dwight</td>
<td>1868-c. 1876</td>
<td>Au Sable</td>
<td>Logged N. Branch; sawmill, docks</td>
<td>e, j, n</td>
</tr>
<tr>
<td>Moore &amp; Alger Co.</td>
<td>1868-1874</td>
<td></td>
<td>Logged n. of the Au Sable; became R. A. Alger &amp; Co.</td>
<td>i, p, r</td>
</tr>
<tr>
<td>Loud, Gay &amp; Co.</td>
<td>1870-1876</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Branch Au Sable River; boomage</td>
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</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. &amp; C. Parks</td>
<td>c. 1870-</td>
<td>Au Sable/Oscoda</td>
<td>Sawmill</td>
<td>e, l, m</td>
</tr>
<tr>
<td></td>
<td>c. 1873</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burrows, Young &amp; Company</td>
<td>c. 1870-</td>
<td>Au Sable/Oscoda</td>
<td>Sawmill; boomage</td>
<td>e, i, l, m</td>
</tr>
<tr>
<td></td>
<td>c. 1883</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. X. Holcher</td>
<td>c. 1870</td>
<td>Au Sable</td>
<td>Pine logging, sawmill</td>
<td>l</td>
</tr>
<tr>
<td>Au Sable Shingle Mill &amp; Lumber Co.</td>
<td>c. 1870</td>
<td>Au Sable</td>
<td>C. Ortmann (Pres.), pine logging, sawmill</td>
<td>i, l</td>
</tr>
<tr>
<td>T. F. Thompson &amp; Company</td>
<td>c. 1871-</td>
<td>Au Sable</td>
<td>Pine logging, rollways, S. Branch &amp; Main Branch</td>
<td>i, j, r</td>
</tr>
<tr>
<td></td>
<td>c. 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schramm</td>
<td>c. 1871-</td>
<td>Au Sable</td>
<td>Logged n. of the Au Sable</td>
<td>p, r</td>
</tr>
<tr>
<td></td>
<td>c. 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andrew</td>
<td>c. 1871-</td>
<td>Au Sable</td>
<td>Logged n. of the Au Sable</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>c. 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jerolman Lumber Co.</td>
<td>c. 1871-</td>
<td>Au Sable</td>
<td>Logged s. of the Au Sable</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>c. 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moull</td>
<td>c. 1871-</td>
<td>Au Sable</td>
<td>Logged s. of the Au Sable</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>c. 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saginaw Lumber &amp; Shingle Co.</td>
<td>c. 1871</td>
<td>Au Sable</td>
<td>Shingle mill</td>
<td>m</td>
</tr>
</tbody>
</table>

(continued)
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<thead>
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<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Smith, Kelley &amp; Co.</td>
<td>c. 1871-c. 1873</td>
<td>Au Sable/Oscoda</td>
<td>Logged pine along Main Branch; sawmill, boomage</td>
<td>m</td>
</tr>
<tr>
<td>Stuart &amp; Co.</td>
<td>c. 1871</td>
<td>Oscoda</td>
<td>Pine logging</td>
<td>m</td>
</tr>
<tr>
<td>Au Sable River Lumber Co.</td>
<td>c. 1872-1906</td>
<td>Au Sable</td>
<td>Log Booming, upper Au Sable River</td>
<td>a,h</td>
</tr>
<tr>
<td>Oscoda Boom Co.</td>
<td>1877-</td>
<td>Oscoda</td>
<td>Log Booming, lower Au Sable River</td>
<td>a</td>
</tr>
<tr>
<td>Van Etten Boom Co.</td>
<td>1879-c. 1891</td>
<td>Oscoda</td>
<td>Log Booming, Van Etten L.; H. N. Loud</td>
<td>a,b,i</td>
</tr>
<tr>
<td>Van Etten Creek Improvement Co.</td>
<td>1879-</td>
<td>Oscoda</td>
<td>Stream maintenance; H. N. Loud</td>
<td>i</td>
</tr>
<tr>
<td>Caldwell &amp; Smith</td>
<td>c. 1873</td>
<td>Au Sable/Oscoda</td>
<td>Sawmill</td>
<td>i</td>
</tr>
<tr>
<td>Moore, Tanner &amp; Co.</td>
<td>c. 1873-c. 1882</td>
<td>Oscoda</td>
<td>Pine logging, sawmill, Main Branch Au Sable R.</td>
<td>i,n,o</td>
</tr>
<tr>
<td>J. E. Potts' Lumber Co.</td>
<td>c. 1874-1890</td>
<td>Potts (McKinley)</td>
<td>Logged N. &amp; S. Branches &amp; Perry Cr.; sold to H. M. Loud; extensive RR system</td>
<td>c,f,j,r</td>
</tr>
<tr>
<td>R. A. Alger &amp; Co.</td>
<td>1874-1881</td>
<td>Au Sable/Oscoda</td>
<td>Pine for ship building became Alger, Smith &amp; Co.</td>
<td>i</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. L. Colwell &amp; Co.</td>
<td>c. 1876</td>
<td>Au Sable</td>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Loud Lumber Co.</td>
<td>c. 1876</td>
<td>Oscoda</td>
<td>Logged n. of Au Sable R.; Placed in trust: O.S.&amp; L. Co.; renamed H. M. Loud &amp; Sons</td>
<td>g,r</td>
</tr>
<tr>
<td>Oscoda Salt &amp; Lumber Co.</td>
<td>1876-c. 1886</td>
<td>Oscoda</td>
<td>Logged N., S., Main Br., &amp; Pine R.; sawmill, RR spurs</td>
<td>f,j,q</td>
</tr>
<tr>
<td>Pack, Woods &amp; Co.</td>
<td>1877-1894</td>
<td>Oscoda</td>
<td>Logged N. &amp; S. Br., &amp; Perry Cr.; Depleted timber &amp; left</td>
<td>f,j,m,r</td>
</tr>
<tr>
<td>W. B. Stillman &amp; Co.</td>
<td>1880-1887</td>
<td>Saginaw</td>
<td>Logged pine &amp; hardwoods; sold to Briggs &amp; Cooper</td>
<td>e</td>
</tr>
<tr>
<td>L. L. Hotchkiss</td>
<td>c. 1881</td>
<td></td>
<td>Pine logging, Iosco &amp; Ogemaw Counties</td>
<td>a</td>
</tr>
<tr>
<td>Alger, Smith &amp; Co.</td>
<td>1881-</td>
<td>Black River</td>
<td>Rafted pine to N.Y. for ship building; logging RR</td>
<td>i</td>
</tr>
<tr>
<td>B. Killmaster &amp; Co.</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged along Pine River</td>
<td>i,j</td>
</tr>
<tr>
<td>Cheesaebrough &amp; Charleton</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged along N. Branch of the Au Sable River</td>
<td>i,j</td>
</tr>
<tr>
<td>Cristy Bros.</td>
<td>c. 1882</td>
<td></td>
<td>Logged Main Br. Au Sable R.</td>
<td>i,j</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. A. MacDonald</td>
<td>c. 1882 - c. 1893</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable &amp; Pine River</td>
<td>8, i, j</td>
</tr>
<tr>
<td>Dease &amp; Hayes</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R.</td>
<td>I, j</td>
</tr>
<tr>
<td>Gardner Bros.</td>
<td>c. 1882</td>
<td>Oscoda</td>
<td>Logged Main Br. Au Sable R.</td>
<td>I, j</td>
</tr>
<tr>
<td>Emery Bros.</td>
<td>c. 1882 - c. 1886</td>
<td>Au Sable/Oscoda</td>
<td>Logged S. Br. Au Sable R.; Sawmill</td>
<td>I, j, q</td>
</tr>
<tr>
<td>I. P. Pulcifer</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R.</td>
<td>I, j</td>
</tr>
<tr>
<td>J. H. Killmaster</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged along Pine River</td>
<td>I, j</td>
</tr>
<tr>
<td>Jones &amp; Porter</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R.</td>
<td>I, j</td>
</tr>
<tr>
<td>Joseph Dudgeon</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R. &amp; Pine R.</td>
<td>I, j</td>
</tr>
<tr>
<td>Kinney &amp; Beard</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R.</td>
<td>I, j</td>
</tr>
<tr>
<td>Martin Bresnaham</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Upper S. Branch Au Sable River</td>
<td>I, j</td>
</tr>
<tr>
<td>McKay Bros.</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged along Pine River</td>
<td>I, j</td>
</tr>
<tr>
<td>Moore, Whipple &amp; Co.</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged S. &amp; Main Branch Au Sable River</td>
<td>I, j</td>
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<thead>
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<th>Dates</th>
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<th>Notes</th>
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<tbody>
<tr>
<td>Penoyar Bros.</td>
<td>c. 1882-1894</td>
<td></td>
<td>Logged N. &amp; Main Branch; Depleted timber &amp; left</td>
<td>f,i,j</td>
</tr>
<tr>
<td>Platt &amp; Millen</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged N. &amp; Main Branch Au Sable River</td>
<td>i,j,n,o</td>
</tr>
<tr>
<td>Roberts &amp; Cowley</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged along Pine River</td>
<td>i,j</td>
</tr>
<tr>
<td>Stephen Moore</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged N. Br. Au Sable R.</td>
<td>i,j</td>
</tr>
<tr>
<td>S. O. Fisher</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged N. Br. Au Sable R.</td>
<td>i,j</td>
</tr>
<tr>
<td>The B. L. Anderson &amp; Company</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Upper S. Branch Au Sable River</td>
<td>i,j</td>
</tr>
<tr>
<td>Thickstan &amp; Manwarring</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R. &amp; Pine River</td>
<td>i,j</td>
</tr>
<tr>
<td>W. H. Clough</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Main Br. Au Sable R. &amp; Pine River</td>
<td>i,j</td>
</tr>
<tr>
<td>Wm. Jenkinson</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged S. Br. Au Sable R.</td>
<td>i,j,q</td>
</tr>
<tr>
<td>Wonderly, Rimington &amp; Co.</td>
<td>c. 1882</td>
<td>Au Sable/Oscoda</td>
<td>Logged Upper S. Branch Au Sable River</td>
<td>i,j</td>
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</table>
| Emery & Jones                 | c. 1884   | Oscoda         | Logged S. Br. Au Sable R.                 | r      |"
<table>
<thead>
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<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Eugene Smith</td>
<td>c. 1884</td>
<td>Oscoda</td>
<td>Logged S. Br. Au Sable R.</td>
<td>r</td>
</tr>
<tr>
<td>Gratwick, Smith &amp; Fryer Lumber Co.</td>
<td>c. 1884- c. 1886</td>
<td>Au Sable/Oscoda</td>
<td>Logged N. Br. Au Sable R.</td>
<td>b,j,q</td>
</tr>
<tr>
<td>H. M. Loud &amp; Sons Lumber Co.</td>
<td>1884-1911</td>
<td>Oscoda</td>
<td>Logged pine, hemlock &amp; hardwood on Big Cr., N. Br. &amp; n. of Au Sable R.; two sawmills destroyed by fire</td>
<td>e,f,h</td>
</tr>
<tr>
<td>Briggs &amp; Cooper Lumber Co.</td>
<td>1887-1905</td>
<td>Rose City/ S. Branch</td>
<td>Logged Ogemaw &amp; Roscommon Co. sold to Prescott &amp; Miller</td>
<td>e,k</td>
</tr>
<tr>
<td>Dave McCallom</td>
<td>c. 1888- c. 1889</td>
<td>Au Sable/Oscoda</td>
<td>Logged Vaughn Cr. headwaters for pine &amp; cedar</td>
<td>b,r</td>
</tr>
<tr>
<td>Maltby Lumber Co.</td>
<td>1889-c. 1901</td>
<td></td>
<td>Hardwood logging NE Ogemaw Co.; RR spur of D.B.C.&amp;A. RR</td>
<td>k</td>
</tr>
<tr>
<td>T. T. Allen &amp; Co.</td>
<td>c. 1899</td>
<td></td>
<td>Logged Au Sable &amp; Pine R.</td>
<td>a</td>
</tr>
<tr>
<td>Prescott &amp; Miller Company</td>
<td>c. 1905</td>
<td>Rose City/ S. Branch</td>
<td>Railroad logging for hardwoods</td>
<td>k</td>
</tr>
<tr>
<td>Fred Thornton &amp; Brother</td>
<td>c. 1906</td>
<td>Oscoda</td>
<td>Logged cedar on Main Br. &amp; cutover from Pack, Woods Co.</td>
<td>b</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>Eastman &amp; Robinson Lumber Co.</td>
<td>1908-1914</td>
<td>Goodar</td>
<td>Sawmill; RR logging for hardwoods &amp; some pine; left after depleting timber</td>
<td>k,r</td>
</tr>
<tr>
<td>Lake Huron &amp; S.W. Railroad</td>
<td>1878-1879</td>
<td>Tawas City</td>
<td>Sold to C. H. Prescott &amp; named Tawas &amp; Bay Co. RR</td>
<td>j</td>
</tr>
<tr>
<td>Tawas &amp; Bay Co. RR</td>
<td>1879-1880</td>
<td>Tawas City</td>
<td>Named Detroit, Bay City &amp; Alpena RR</td>
<td>j</td>
</tr>
<tr>
<td>Detroit, Bay City &amp; Alpena RR</td>
<td>1880-1894</td>
<td>Bay City to Cheboygan</td>
<td>Common carrier, logging RR, &amp; spurs; chartered as Det. &amp; Mackinac Railway</td>
<td>j</td>
</tr>
<tr>
<td>Detroit, Bay City &amp; Alpena RR</td>
<td>1893-1930</td>
<td>Emery Jct. to Maltby/Rose C.</td>
<td>Became part of Detroit &amp; Mackinac Railway; abandoned</td>
<td>k,r</td>
</tr>
<tr>
<td>Detroit &amp; Mackinac Railway</td>
<td>1894-1930</td>
<td>Bay City to Cheboygan</td>
<td>Abandoned</td>
<td>j,k,r</td>
</tr>
<tr>
<td>J. E. Potts' Lumber Co. Railroad</td>
<td>c. 1888-1890</td>
<td>Potts to Au Sable/Damon</td>
<td>Sold to H. M. Loud &amp; named Au Sable &amp; Northwestern RR</td>
<td>k,r</td>
</tr>
<tr>
<td>Robinson's RR</td>
<td>1908-c. 1916</td>
<td>S. Branch into Oscoda Co.</td>
<td>Logging RR &amp; spurs; abandoned</td>
<td>k,r</td>
</tr>
<tr>
<td>Au Sable &amp; Northwestern RR</td>
<td>1891-1907</td>
<td>Au Sable to Comins</td>
<td>Logging RR; Renamed A.S. &amp; N.W. Railway</td>
<td>j</td>
</tr>
</tbody>
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<tr>
<th>Company</th>
<th>Dates</th>
<th>Base</th>
<th>Notes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Au Sable &amp; N.W. Railway</td>
<td>1907-1911</td>
<td>Au Sable to Comins/Curran</td>
<td>Abandoned after fire; sold to D. &amp; M. Railway; enlarged to standard gauge</td>
<td>j</td>
</tr>
<tr>
<td>Detroit &amp; Mackinac Railway Co.</td>
<td>1912-1927</td>
<td>Au Sable to Comins/Curran</td>
<td>Abandoned due to limited freight</td>
<td>r</td>
</tr>
</tbody>
</table>

\(^\text{a}(\text{Allen 1942:25,42,46,48}).\)
\(^\text{b}(\text{Ellis 1975:19,65,85,109}).\)
\(^\text{c}(\text{Fitzmaurice 1979:70}).\)
\(^\text{d}(\text{Goodstein 1974:44}).\)
\(^\text{e}(\text{Hotchkiss 1898:63,96,134,156,161-162}).\)
\(^\text{f}(\text{MacDonald 1942:13-14,26}).\)
\(^\text{g}(\text{Michigan State Board of Health 1894:186}).\)
\(^\text{h}(\text{Miller 1963:38,42}).\)
\(^\text{i}(\text{Page 1883:113,162,184-185,189-190,269}).\)
\(^\text{j}(\text{Powers 1912:109,186,188-189,204-205,207-208,511}).\)

(Saginaw Daily Courier 1870: 2).

m (Saginaw Daily Courier 1871a: 1, 4).

n (Saginaw Daily Courier 1876: 4).

o (Saginaw Daily Courier 1878: 4).

P (Saginaw Daily Courier 1881: 4).

q (Saginaw Daily Courier 1886: 4).

r (USDA FS n.d.: 5-7).
APPENDIX B

USDA Forest Service Landtype Association (LTA) Categories Identified on the Huron National Forest

1. This unit is comprised of jack pine, scrub oak, sweetfern, and some red pine on extensive, very flat, non-pitted outwash sand plains.

2. This unit contains predominately scrub oak, jack pine, red pine, bracken, and some white pine on flat outwash sand plains.

3. In this unit scrub oak, jack pine, red pine, bracken, and some white pine are found on very flat, poorly drained outwash plains.

4. Scrub oak, jack pine, red pine, bracken, and some white pine characterize this unit on dissected pre-existing outwash sand plains.

5. This unit is comprised of scrub oak, jack pine, red pine, bracken, and some white pine on rolling and pitted outwash sand plains which contain numerous small potholes, lakes and ponds.

6. This unit consists of the beech-sugar maple association, together with some white ash, white pine, and red oak, on slightly rolling, sandy outwash overlying till, lake deposits, or water perched on these deposits.

7. This unit of black oak, aspen, and pine occupies low, dry, and sandy morainal hills which contain some poorly drained lakes, marshes, or bogs.
8. In this unit oak, aspen, red maple, and pine are found on low, dry, and sandy morainal hills with some poorly drained lakes, marshes, or bogs.

9. This unit contains red maple, red oak, and aspen on moderately sloping low morainal hills which are pitted with numerous potholes and kettle depressions.

10. Red maple, red oak, and aspen predominate on steeply sloping morainal hills which contain numerous potholes and kettle depressions. Also present are beech, sassafras, sugar maple, and white pine.

11. This unit is comprised of beech and sugar maple on low morainal hills usually pitted with potholes and kettle depressions. Also associated are yellow birch, hemlock, and basswood, black cherry, and white pine.

12. This unit contains a beech-sugar maple association on moderate to high morainal hills with some steep slopes and pitted with numerous potholes and kettle depressions. Yellow birch, hemlock, basswood, black cherry, and white pine are also present.

13. This lowland unit contains aspen, spruce, balsam fir, red maple, oak, and paper birch on low, flat, hummocky and wet sand plains.

14. This unit is comprised of cedar, spruce, and balsam fir on low valley plains, marshes, and organic alluvium, usually adjacent to water courses.
15. This unit contains sugar maple, beech, and white ash on low clayey hills, usually ground moraines or dissected lacustrine deposits.

16. In this unit sugar maple, beech, and ash dominate flat hummocky and clayey plains, glacial lakebeds, or ground moraines.

17. This unit is composed of a beech-sugar maple association on flat to rolling, loamy outwash plains and ground moraines which contain some internally drained potholes.
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Fitzmaurice, John W.  

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