A FUNCTIONAL GEOGRAPHIC APPROACH TO THE UTILIZATION OF THE NORTHERN MICHIGAN FOREST RESOURCE

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ABSTRACT

A FUNCTIONAL GEOGRAPHIC APPROACH TO THE UTILIZATION OF THE NORTHERN MICHIGAN FOREST RESOURCE

by David E. Kromm

The forest, one of the most important resources in our Western society, has contributed to the progress of man since the beginning of civilization. It is the purpose of this thesis to investigate the role of forest exploitation as an agent in formulating the spatial structure of a forested area. The character of the relationship between the utilization of a forest resource and the organization of human activity in space is viewed as a function of the method by which the resource is appropriated for use. Within a conceptualized framework of forest exploitation sequences of depletion and management for continuous production, the behavior of the Northern Michigan lumber industry between 1850 and 1910 and of the pulp and paper industry following World War II is observed. These industries, which dominated exploitation of the resource during their respective time periods, connect the concepts of forest utilization and the human organization of activity in space. Observing the processes of forest resource utilization in Northern Michigan

provides the basis for establishing generalizations regarding the consequential relationship between resource utilization and spatial organization. The patterns of forest utilization found in Northern Michigan are common to forested regions throughout the nation.

In a depletion or mining model, the inputs influencing man's activities in space which result from forest utilization are terminated when the timber is removed from the landscape. In a sequence whereby the resource is managed for continuous production, the inputs influencing the human organization of space which are generated by forest exploitation persist through time. During Northern Michigan's lumbering era, the activity-inducing inputs generated by the conversion of the resource to useful products stimulated economic growth and development. But as a result of the mining, the forest resource was depleted. The economic activity of the region was greatly altered as the inputs resulting from forest exploitation were terminated and new means of support were sought.

Because of the germination of a second-growth forest that is effectively managed for sustained yield, Northern Michigan presently is able to support an expanding and economically important pulp and paper industry. In approaching the persisting influence of a managed forest resource,

consideration is given the notion that the potential of the resource to influence the human arrangement of activity within a region is in large measure determined by the comparative advantage of the area for forest product industries. Northern Michigan's competitive position with respect to the pulp and paper industry varies with the locational control considered, but the region's strongest advantage is proximity to a major market area for paper and board products. In general, the region's relative advantage for the pulp and paper industry lies within the manufacture of products which can be produced from locally available species and for which there exists a large nearby market.

The utilization of the Northern Michigan forest resource to support an expanding pulp and paper and particle board industry contributes substantially to the economic activity of the region. But it is observed that the basic extensive structure persisted as the utilization of the forest progressed from exploitation without regard for future production to management of the resource for sustained yield. It is suggested that, as regions dependent on forest product industries are usually heavily forested and sparsely populated, few have an organization of social and economic activity mature enough to supply needed technology, non-wood materials and mechanical inputs, or to purchase the products

of the industry. As a result of this space-using character of forestry, forested regions do not benefit proportionately from the multiplier effect of expansion in resource-based industry and are restricted in the extent of participation in economic growth and development.

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CHAPTER I

INTRODUCTION

Part 1. The Concept of Resources

Man and Resources

Geographers are vitally concerned with the variable landscape of the surface of the earth as it is modified through the interchange between man and his environment. To support his desire for economic and social well-being, man interacts in a diverse manner with his environment, resulting in an infinite number of landscape patterns. Employing intellect and manipulative ability, man utilizes selected elements of his environment to achieve his goals. Illustrating this process, Mesolithic man pursued a livelihood of hunting and gathering, searching for water, animals, fruits and nuts. Those elements that he appropriated for sustenance comprised the useful part of his environment. In modern terminology, they constituted the Mesolithic man's natural resources.[1]

To the contemporary American, resources embody many more elements of the environment, including water, forests,

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[1]Hereafter interchanged freely with the word "resources."

mineral fuels and a wide spectrum of metals. With the exception of water, and perhaps the forest, these phenomena were either unknown or of no use to the Mesolithic hunter and gatherer. For the ancients, coal and oil did not exist; for tens of centuries man throughout the world walked on gold, silver and other precious metals without seeing any value in them. Resources are a relative phenomenon that varies in time.

But resources also vary in space. As there exists an enormous range in abundance among the elements of the earth's surface, the fixed location of resources is often of great significance in their use. The uneven distribution of uranium ore illustrates the problems associated with spatial variation. When American scientists began a systematic search for the resource in the early 1940's, the most useful deposits were found in the Belgian Congo. Because this location was deemed strategically unacceptable, an immediate attempt was made to find uranium nearer our country. Soon additional deposits were found in Canada, and through increased effort, valuable trace occurrences have been identified in large areas of the United States.[1] In the case of uranium, technology was employed to overcome the unsatisfactory spatial variation that existed following initial exploration.

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[1]Thomas B. Nolan, "The Inexhaustible Resource of Technology," in Perspectives on Conservation, ed. Henry Jarrett, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1958), p. 58.

Resources cannot be defined merely by the existence of certain elements in the environment. Man's perception of these elements denotes what is and what is not a resource; without man, there are no resources. Resources comprise that part of the environment which man finds useful. Zimmermann asserts that "usefulness to man, capacity to satisfy human wants, stamps environmental aspects as resources."[1] In this paper, the term "resource" refers to those elements of the natural environment which man uses to assist his attainment of social and economic goals.[2]

Resources are relative because they are not only natural phenomena but are also cultural phenomena. In the words of Broek, "Each culture has its own appraisal of the utility of the earth's elements--in other words its own resource pattern."[3] Through the application of certain features of culture, notably technology and scientific knowledge, resources assume their meaning and significance in a society. Technological advancement alters both man's

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[1]Erich W. Zimmermann, World Resources and Industries: A Functional Appraisal of the Availability of Agricultural and Industrial Resources (New York: Harper & Brothers, 1933), p. 3.

[2]This would exclude man and his works except for those segments of the natural (biotic) environment which were not physically created by man but were in some form changed by his actions. In this broad definition, a forest plantation or fertilized soil would be a resource, but a highway or a dam would not.

[3]Jan O. M. Broek, "Discourse on Economic Geography," Geographical Review, XXXI (October, 1941), p. 664.

awareness of resources and his ability to use them.[1] Few of the combinations of elements that the contemporary American identifies as resources are of any use to the indigenous population of Micronesia or to the Australian Aboriginal, or even to the more sophisticated inhabitant of the Bolivian Altiplano. At present, uranium is not a resource to the people of Finland or Argentina or Thailand. Conversely, the reindeer hides sought after and prized by the Lapp are of little meaning to the resident of Baltimore or Kansas City. Culture also governs the number and kinds of elements that the society chooses to use. Often, this takes the form of a religious belief which restricts the use of specified animals, minerals or other elements of the environment. There exists an essential correlation between the culture pattern and the environmental substances which are considered useful.[2]

Because of the profound connection between resources and culture, examination of the elements of the environment employed by various societies serves as an important key in the understanding of man's organization of his institutional

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[1]Joseph L. Fisher, "Natural Resources and Technological Change," Land Economics, XXIX (February, 1953), p. 61.

[2]Within each culture differences exist as to how those elements selected as resources are viewed. For example, in looking at the soil resource of a Georgia plantation, a conservation officer, a tenant farmer and the property owner may possess conflicting ideas with regard to the utilization of this element of the environment, with all of them agreeing on its value as a resource.

and sustenance patterns.[1] The patterns and organization of human occupance may be seen as the outgrowth of human choice achieved within the framework of the technology, values, restrictions and other components of the cultural setting. Through cultural interaction with the environment, each society appropriates a unique combination of elements and continuously alters the contents of this amalgamation through time. As a result of this dynamic process, resources are relative in the time, space and culture dimensions.

Considerations in Resource Utilization

In viewing the concept of resource utilization, many scholars have probed the behavior of resources from the perspective of contrasting cultural settings.[2] For through the mechanism of varying motives, differing cultures produce unique patterns of resource utilization. In order to limit the influences of this diversity in this thesis, resource utilization will be viewed through the cultural-economic structure characteristic of Anglo-America. Many of the

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[1] Vincent Ostrom, "The Social Scientist and the Control and Development of Natural Resources," Land Economics, XXIX (May, 1953), p. 105.

[2] Among these works are Walter Firey, Man, Mind and Land: A Theory of Resource Use (Glencoe, Illinois: The Free Press, 1960), pp. 19-38; Allen K. Philbrick, This Human World (New York: John Wiley and Sons, 1963), pp. 20-34; Carl O. Sauer, "Theme of Plant and Animal Destruction in Economic History," Journal of Farm Economics, XX (1938), pp. 765-75; and Erich W. Zimmermann, pp. 138-54.

concepts would probably apply in most other societies because of certain qualities inherent in an individual resource, while others are likely to be much less universal, applying only in the "Western" form of social and economic organization.

It is also recognized that the behavior of individual resources in the same cultural-economic setting differs and that no one principle of resource utilization or conservation would apply to all. Though certain categories may in time be fully exploited, resources as a whole cannot be exhausted.[1] The problem of conceptually approaching the varied character and availability of resources has resulted in the establishment of several classifications. Two such categorizations will be examined, one based on the relative availability of resources for economic extraction and another on the relative renewability of resources. Based on the criterion of relative renewability (or exhaustibility), three principal classes of resources have been distinguished:

(1) Fund or stock resources--Resources for which the total supply is relatively fixed and non-renewable. Fund resources include metals, mineral fuels, coal, stone, gravel, sand and peat soils.

(2) Flow resources--Resources issued in a continuous stream which persists regardless of whether they are used or

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[1]Conrad H. Hammar, "Society and Conservation," Journal of Farm Economics, XXIV (February, 1942), p. 112.

not. Flow resources include precipitation, water in streams and lakes, sunlight and wind.

(3) Biological resources--Resources which are replaceable over time, providing care is taken to insure their continued production. Biological resources include crops, pasture, wildlife, fish and forests.[1]

In their examination of energy resources, Schurr and Netschert introduced new terminology regarding relative availability that is applicable to other resources as well. Three concepts of resource availability were developed:[2]

(1) Reserves--The stocks of a resource as viewed by the operator producing it. Reserves are defined in terms of immediate- or short-term economic feasibility.

(2) Resource base--The sum total of a resource present within a given geographical area. The resource base establishes the outer physical limit of a resource.

(3) Resources--The part of the resource base which seems likely to become available given certain technologic and

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[1]Raleigh Barlowe, Land Resource Economics: The Political Economy of Rural and Urban Land Resource Use (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958), p. 285.

[2]In a similar discussion, Lovejoy and Homan likened the relative availability to a set of concentric circles which widen as economic feasibility for extraction declines. Wallace F. Lovejoy and Paul T. Homan, Methods of Estimating Reserves of Crude Oil, Natural Gas, and Natural Gas Liquids, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1965), p. 147.

economic conditions. Resources may be defined according to any relevant technical and economic criteria selected.[1]

In Western society, problems of utilization, conservation and management of resources are usually approached through the consideration of the relative renewability and availability of resources. Although fund resources have a fixed supply, depletion has been partially offset through increased efficiency in their recovery and processing and by the substitution of flow and biological resources or more plentiful stock resources for those in diminishing supply. Also, in considering the depletion of fund resources, attention is given to the possibility of new discovery or of tapping even larger deposits of the resource base as increased demand lowers the acceptable grade.[2] In this fashion, the iron ore reserves of the United States have been significantly increased through the utilization of taconite. The resource base concept emphasizes the wide possibilities awaiting realization through technology.

Although the supply situation with respect to the flow and biological (renewable) resources varies with the

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[1]Sam H. Schurr and Bruce C. Netschert, with Vera F. Eliasberg, Joseph Lerner and Hans H. Landsberg, Energy in the American Economy, 1850-1975: An Economic Study of its History and Prospects, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1960), pp. 296-97.

[2]Donald Carlisle, "Nonfuel Mineral Resources," Chapter 14 of Natural Resources, ed. Martin R. Huberty and Warren L. Flock (New York: McGraw-Hill Book Company, Inc., 1959), pp. 353 and 355.

particular element considered, in general it is assumed that they serve society best when carefully exploited and managed for continuous production. If they are not used, they are lost--water in a stream is wasted unless harnessed to provide power, irrigate crops or supply municipal and industrial water needs. But when used, the renewable resources must be managed to maintain continuous supply. Without proper care, water resources are lost through pollution, soil resources through erosion and exhaustion, wildlife resources through starvation or slaughter. Because of the waste of renewable resources through inadequate management practices, there is a concern for their future supply. The primary objective of investigating the nature of resources and resource utilization is to learn more about their behavior so that they can be more effectively exploited to serve man through time. It is hoped that greater knowledge of resource behavior will facilitate producing additional products and services for society while depleting available reserves as little as possible in the process.[1]

Scarcity of Resources

A foremost concern in resource studies that has stimulated research on the nature of resources is the question of

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[1]Joseph L. Fisher, "Natural-Resources Research Problems," Chapter 20 of Natural Resources, ed. Huberty and Flock, p. 528.

whether man is "overusing" resources to the eventual detriment of society as a whole. The classic Malthusian statement of the problem contends that resource growth is not as dynamic as population growth, and therefore there exists a fixed population ceiling which can be supported by the resource base.[1] But the shortage of resources that was seen as imminent by Malthus in 1798 never occurred. Instead, living conditions for the world as a whole improved as technological advances introduced new resources and techniques of obtaining increased benefit from previously exploited resources. For many years, there existed what is sometimes termed a cornucopian concept of resources, which asserted that technology and inventiveness would provide a never-ending storehouse of resources. However, at the present time, some scholars question whether the technological advances which seem to disprove the postulations of Malthus and other classical economists are sufficient to insure an adequate resource base for the world's burgeoning population. For example, Fuller declares that "the likelihood of critical situations in the world's stock of resources is hardly debatable; the only real uncertainty is the timetable."[2] But other investigators maintain that

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[1]Richard T. Ely and George S. Wehrwein, Land Economics (Madison: The University of Wisconsin Press, 1964), p. 2.

[2]Varden Fuller, "Natural and Human Resources," Chapter 1 of Natural Resources, ed. Huberty and Flock, p. 3.

there are no real shortages of resources today and that no scarcity will occur in the forseeable future. These researchers advance the contemporary view that unit cost of production is the best measure of scarcity and that shortages will merely be reflected in increased prices.[1]

Since the publication of the report of the President's Materials Policy Commission in 1952, the concept that resource scarcity is largely a matter of cost has gained wide acceptance.[2] The Paley Report stated that "the quantity of materials we can have in the future will be determined in great measure by what we can afford to pay for them, not simply in money but even more importantly in human effort, capital outlay, and other productive energies."[3] In his study on mineral economics, Herfindahl proposed that, as many of the physical alternatives in resource development are not economically feasible at a given point in time or space, the most useful way to approach the question of shortages is in terms of cost.[4] Also supporting this view of

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[1]As demand is assumed to be the determinant of the effort which will be expended to appropriate a given resource and therefore its price, the terms "cost" and "price" are used interchangeably in this discussion.

[2]As the commission was chaired by William S. Paley, its publication is commonly referred to as the Paley Report.

[3]Resources for Freedom, a Report to the President by the President's Materials Policy Commission (Washington: U.S. Government Printing Office, 1952), Vol. I: Foundations for Growth and Security, p. 13.

[4]Orris C. Herfindahl, Three Studies in Minerals Economics (Washington: Resources for the Future, Inc., 1961), p. 13.

resource scarcity, McDivitt asserts that "past shortages have been due to inability to keep up with sudden surges in demand rather than to any basic lack of natural resources--due, that is, to inadequacy in plant, not of raw material."[1]

As pointed out by Herfindahl, in the cost of production doctrine of natural resource scarcity it is not the physical but the economic limit of a material that determines the existence of scarcity. For the development of a resource to take place in Western society, it must be of sufficient quality to be produced at a profit. It is not a question of physical depletion of reserves but a gradual decrease in grade or accessibility resulting in higher costs.[2] As demand increases, reserves are depleted and lower quality and less accessible deposits are brought into use; the economic limit of utilization is then defined by the additional capital and labor inputs society is willing to employ to put the resource in use.

Contemporary concepts regarding the relationships between resource scarcity and economic growth are rooted in the works of the classical economists, Malthus, Ricardo and Mill. In their penetrating work on resource scarcity and

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[1]James F. McDivitt, Minerals and Men: An Exploration of the World of Minerals and its Effect on the World We Live In, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1965), p. 10.

[2]Ibid., p. 25.

growth, Barnett and Morse show that the classical economists professed that resource scarcity would lead to diminishing social returns to economic effort and a retardation and cessation of economic growth.[1] Scholars today reject the economic pessimism and determinism of classical thought and view the social effects of scarcity as a dynamic force which reduces labor productivity and increases the real costs of all products. As rising costs of resource extraction divert manpower and capital from other productive efforts, the total output of goods and services is reduced.[2] But McGann asserts that, even if through scarcity the real price of resources does increase relative to other goods and services, the actual effect on overall income would be negligible as the processing of resources accounts for a very small part of world income.[3]

Using increasing unit cost as the measure of scarcity, several investigations have been made into the allegations of certain conservation-minded scholars and laymen that the world resource base has been severely depleted in the past

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[1]Harold J. Barnett and Chandler Morse, Scarcity and Growth: The Economics of Natural Resource Availability, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1963), p. 2.

[2]Resources for Freedom, Vol. I, p. 13.

[3]Paul W. McGann, "Economics of Mineral Exploration," in Science and Resources: Prospects and Implications of Technological Advance, ed. Henry Jarrett, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1959), p. 109.

fifty or one hundred years. Based on five indicators of scarcity,[1] Fisher and Potter found that the relative scarcity of the resources they considered decreased continuously between 1870 and 1960 for both the United States and the world as a whole.[2] After examining the record of selected mineral products prices in the United States, Herfindahl concluded that "deterioration in the underlying natural resource conditions has not been great enough to counter-balance the cost reduction that has taken place over the years."[3] For the period 1870-1957, Barnett and Morse discovered that for agriculture and minerals, unit costs were not only reduced but declined more significantly in the more recent years when it would be expected that they be more scarce. However, their data for forestry and fishing were inconclusive.[4]

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[1]The five indicators of resource scarcity established by Fisher and Potter are: (1) Production and/or consumption trends for major resource products; (2) employment per unit of output, as a measure of labor productivity trends in resource industries; (3) relative price and/or cost trends for resource commodities as compared to trends of prices and/or costs in general; (4) trends in exports and imports, or net foreign trade; (5) trends in the rate of production and use of resources compared to estimated stocks, reserves, or potentials. Joseph L. Fisher and Neal Potter, World Prospects for Natural Resources: Some Projections of Demand and Indicators of Supply to the Year 2000 (Washington: Resources for the Future, Inc., 1964), pp. 2-3.

[2]Ibid., p. 18.

[3]Herfindahl, p. 34.

[4]Barnett and Morse, p. 199.

The most important countervailing force reducing the real cost of most resources over time has been technology. The benefits accrued through technological innovation have been wide-ranging, influencing all aspects of resource production. Improved procedures for the discovery of metals and mineral fuels have been developed which have increased the known reserves of many resources. Better methods of effectively mining and extracting lower-grade metals have facilitated the economic use of poorer deposits. Because of more efficient mining procedures, many enterprises continue to reduce their unit costs despite decreasing grade, deeper deposits, higher stripping ratios and rising wages.[1] Twentieth century innovation in forestry provides an example of the role of technology in maintaining resource cost. First the logging truck and the chain saw were introduced and more recently tractors and mechanical log loaders, all of which contributed to maintaining a constant price for pulpwood.[2] By broadening the scale of quality and accessibility at which a given material can be profitably produced, technology has actually created additional resources.

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[1]James Boyd, "The Pulse of Exploration," in Science and Resources: Prospects and Implications of Technological Advance, ed. Jarrett, p. 94.

[2]Henry Clepper and Arthur B. Meyer, The World of the Forest, prepared with the Society of American Foresters (Boston: D. C. Heath and Company, 1965), p. 83.

In another aspect of technology, synthetic materials are being produced which are identical to scarce resources in form and use but which are manufactured from different raw materials.[1] Other factors which serve to reduce or maintain the cost of resources are the substituting of the more plentiful resources for those which are short in economic supply and the increased use of relatively inexpensive energy to produce materials.[2] According to Barnett and Morse, resource expansion is a continuous function of production, as "resource searching, finding, and innovation are built-in responses of a growing economy in the modern age."[3] McDivitt summarizes the effect of innovation on the economic supply of resources in stating that "the technological aspect . . . moves us ever forward, on the one hand to greater use, on the other to greater supply, and considerations of cost and price in the long run tend to establish a reasonable balance between the two."[4]

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[1]Earl P. Stevenson, "Past Gains and Future Promise," in Science and Resources: Prospects and Implications of Technological Advance, ed. Jarrett, p. 117.

[2]John A. S. Adams, "New Ways of Finding Minerals," in Science and Resources: Prospects and Implications of Technological Advance, ed. Jarrett, p. 76.

[3]Barnett and Morse, p. 161.

[4]McDivitt, p. 143.

Because of insufficient knowledge on which to project the future course of unit costs of resources, it is difficult to meaningfully consider the prospective availability of resources. In a detailed study of the future supply of the major metals, Netschert and Landsberg found no reason to expect a significant rise in prices prior to the year 2000.[1] From their examination of world prospects for natural resources, Fisher and Potter foresee no general increase in scarcity in technologically advanced areas.[2] As there is an abundance of resources in the physical sense of the term, many investigators believe that with an increased use of nuclear power, energy costs will be reduced enough[3] to facilitate the processing of large quantities of low-grade materials economically.[4]

The Contribution of Resources to Man's Economic Well-Being

As resources comprise those elements of the environment which man finds useful, their exploitation necessarily contributes to his economic well-being. This principle

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[1]Bruce C. Netschert and Hans H. Landsberg, The Future Supply of the Major Metals: A Reconnaissance Survey (Washington: Resources for the Future, Inc., 1961).

[2]Fisher and Potter, p. 66.

[3]Schurr and Netschert, p. 4.

[4]Harrison Brown, The Challenge of Man's Future (New York: The Viking Press, 1954), p. 220.

implies that the magnitude of the resource base available to a society determines its contribution to the economy. Employing this logic, scholars in the past have contended that resources are the significant feature in explaining the economic growth of Anglo-America and other highly developed regions.

Although this direct causal relationship between economic well-being and resources is now denied, the role of resources is considered to be significant. Referring to the place of resources in the economic well-being of the United States, Boelter asserts, "Natural resources are the bulwark of the nation. The range of resources and the quantities and location of resources at its disposal are measures of the nation's potential."[1] The perpetual character of the contribution is stressed in Landsberg's statement, "Natural resources are as important to the nation's survival as they ever were."[2] Relating resources to advancement and welfare, Fuller declares, "The maintenance of progress and prosperity in industrial countries requires a prodigious and accelerating consumption of resources and raw materials."[3]

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[1]L. M. K. Boelter, "Prologue," in Natural Resources, ed. Huberty and Flock, p. xvii.

[2]Hans H. Landsberg, Natural Resources for U.S. Growth: A Look Ahead to the Year 2000, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1964), p. 1.

[3]Fuller, p. 3.

Control and use of resources alone inadequately explain the relative economic well-being of certain areas, for they fail to account for the comparative depression of such resource-endowed areas as Brazil, Argentina and India. The effective use of resources only partially explains the standard of living in Denmark or Holland. It is evident that a combination of factors influences the relative well-being of a society. According to Perloff et al., the analytic framework of economic growth operates with four variables: population, technology, organization and material resources.[1] To this list Ginsburg adds capital.[2] Resources are viewed as one of several salient factors to be considered in explaining the economic development of a society. This, of course, leaves unanswered the question: What is the role of resources?

The process of economic growth is complex, and the factors which enter into it are mutually interdependent.[3] In the words of Perloff et al., "Natural resources do not acquire significance in economic growth until they are confronted by a highly motivated population equipped with

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[1]Harvey S. Perloff et al., Regions, Resources and Economic Growth, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1960), p. 287.

[2]Norton Ginsburg, "Natural Resources and Economic Development," Annals of the Association of American Geographers, XLVII (September, 1957), p. 203.

[3]Ibid., p. 204.

technology and organization to develop them."[1] According to this view, resources assume a passive function, serving as the object of improvement rather than as a vehicle of development. For without introducing certain cultural elements, resources do not contribute to the economic well-being of man.

In lesser developed economies, Ginsburg views resources as agents for the rapid formulation of capital.[2] By importing technology to convert resources to capital, credit is provided to purchase manufactured machines and equipment. These materials in turn facilitate the exploitation of resources and accelerate economic growth. A classic example of this relationship is the sheikdom of Kuwait. But as pointed out by Adler, foreign investment for the development of resources does not necessarily induce economic development in the host country. He asserts that the concentration of investment in resources often has little influence on the expansion of the overall economic structure.[3] Generally speaking, the role of resources in capital formulation is even less significant for the highly

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[1] Perloff et al., p. 287.

[2] Ginsburg, Annals of the Association of American Geographers, XLVII, p. 204.

[3] John H. Adler, "Changes in the Role of Resources at Different Stages of Economic Development," in Natural Resources for Economic Growth, ed. Joseph J. Spengler (Washington: Resources for the Future, Inc., 1960), p. 63.

developed, machine-oriented societies.[1] However, it is probable that, as a result of transportation improvements and the use of more ubiquitous grades of resources, the influence of resource possession will decline and larger benefits will accrue to the more technically advanced peoples.[2]

A significant contribution of resources in all societies revolves around the concept that resource utilization facilitates man's ability to cope with his total environment.[3] Through the conversion of resources to power and energy, man has greatly extended his capacity to control his livelihood. To quote Zimmermann, "The most important contribution which minerals, both fuels and metals, have made to the development of modern civilization is the increased efficiency in human productive effort."[4]

Utilization of the Forest Resource

This dissertation will be primarily concerned with the forest resource, a resource which has long been

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[1]Theodore W. Schultz, "Connections between Natural Resources and Economic Growth," in Natural Resources for Economic Growth, ed. Spengler, p. 3.

[2]Morris Miller, "The Scope and Content of Resource Policy in Relation to Economic Development," Land Economics, XXXVII (November, 1961), p. 305.

[3]J. Russell Whitaker and Edward A. Ackerman, American Resources: Their Management and Conservation (New York: Harcourt, Brace and Company, 1951), p. 357.

[4]Zimmermann, p. 431.

significant to human progress and is one of the most extensive elements of the environment to which man has attached value. Covering nearly one-third of the earth's land area, the forest resource is one of the most prominent aspects of the landscape. Most of the generalizations regarding resources discussed in the preceding sections apply to the forest resource. In this section, the unique role the forests occupy in the progress of man is studied.

Since the first fruit was plucked from a tree, the forest resource has contributed to human society. Bearing fruit and nuts, providing natural shelter and being a haven for animals, the forest afforded sustenance to the primitive hunter and gatherer.[1] For thousands of years, man has warmed himself and cooked his food with wood fires. Using the forest for protection, men have long sought refuge from others. In this manner, the Finns and Lithuanians retained their cultural integrity, and the Gauls resisted the advances of Caesar.[2] With the innovation of metal working in bronze and then iron, wood was used as fuel, and when the resulting metals were fashioned into tools, the clearing of the forests and the production of wooden implements was

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[1]Raphael Zon, "Forests and Human Progress," Geographical Review, X (September, 1920), p. 155.

[2]Ibid., p. 147.

facilitated.[1] Where wood and charcoal were available to fire the ovens, the initial industrialization of Europe began.[2] Greeley notes that "ever since Hiram, King of Tyre, shipped rafts of fir and cedar from the Mediterranean Coast to trade with the Jews of Solomon's day, timber has been an important factor in the commerce of nations."[3]

In America, the forest furnished the Indians with food, shelter and raw material for clothing. For the colonist, the forest supplied the foundations of the economy--logs for construction, game and other food, fuel for heat and cooking and commercial products such as masts and barrel staves for export.[4] But in discussing the role of the forest resource in human society, a continuing reappraisal is needed, for its significance increases with man's ability to harness the benefits of the resource. To quote Smith and Phillips, "Man cannot get along without wood. It has been useful in all stages of civilization, and the more

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[1] Paul B. Sears, "The Importance of Forests to Man," in A World Geography of Forest Resources, ed. Stephen Haden-Guest, John K. Wright and Eileen M. Teclaff, American Geographical Society Special Publication No. 33 (New York: The Ronald Press, 1956), p. 4.

[2] Edwin J. Cohn, Jr., Industry in the Pacific Northwest and the Location Theory (New York: King's Crown Press [Columbia University], 1954), p. 4.

[3] W. B. Greeley, "The Relation of Geography to Timber Supply," Economic Geography, I (March, 1925), p. 1.

[4] Richard M. Highsmith, Jr., J. Granville Jensen and Robert D. Rudd, Conservation in the United States (Chicago: Rand McNally & Company, 1962), p. 117.

civilization advances, the greater is the service it renders."[1] In addition to this utilitarian value, the forest provides an aesthetic pleasure which relates to the intangible aspects of human life.[2]

Man does not always view the forest as functional but instead perceives in the forest a barrier.[3] To the pioneer settling a virgin land, the dense primeval forest may be an obstacle rather than a resource. Much of the early history of Europe is related to the clearing of the forest so that an agricultural society could prosper. In America, the heavy stands of timber were often viewed as a barrier to the extension of agriculture. The colonist also saw the forest as a shelter for the hostile Indians.[4] As with all elements of the environment that man finds useful, the forest resource is relative in time, space and cultural setting.

As a resource, the forest possesses three attributes which make it one of the most useful elements of the environment for modern Western society: it is versatile,

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[1]J. Russell Smith and M. Ogden Phillips, Industrial and Commercial Geography (New York: Henry Holt and Company, 1940), p. 331.

[2]Sears, p. 10.

[3]Zon, Geographical Review, X, p. 140.

[4]John A. Zivnuska, "Forest Land and Forest Products," Chapter 12 of Natural Resources, ed. Huberty and Flock, p. 262.

abundant and renewable.[1] In stressing the value of the resource, Glesinger asserts that "utilization of the full resources of the forest would constitute a major bloodless, beneficent world revolution."[2] The scope of the contributions of the forest resource appears boundless. Forests produce timber, protect watersheds, support wildlife, provide recreation and furnish forage. Additionally, forests supply food and many products useful to man, including camphor, terpentine, rosin and cork.[3] And throughout much of the world, wood remains the principal fuel. This thesis devotes primary attention to the forest's most direct economic contribution to man, the ability to produce wood.

Several characteristics of wood enable the substance to provide man varied service. Easy to work with, strong for its weight and a good insulator, wood can withstand shocks and vibrations, does not rust, fastens easily with nails or screws and is adaptable to many uses.[4] Because of this unique versatility, wood supplies food for men and animals, is the second most important source of textile

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[1]Egon Glesinger, The Coming Age of Wood (New York: Simon and Schuster, Inc., 1949), pp. 5-6.

[2]Ibid., p. 6.

[3]Roland R. Renne, Land Economics: Principles, Problems, and Policies in Utilizing Land Resources (New York: Harper & Brothers, 1958), p. 466.

[4]Zivnuska, p. 269.

fibres and furnishes fuel and lubricants.[1] In Anglo-America, wood is utilized primarily for lumber employed in construction and for pulp used in the paper and paperboard industry. A number of lesser products are manufactured from wood, including poles, pilings, charcoal, railroad ties, mine timbers and cooperage.[2]

As stated above, the forest resource is both abundant and renewable. Despite the forest's position as a residual land use because of its less exacting site requirements, forests extend over some 9.5 billion acres, covering nearly one-third of the world's total land area.[3] Compared to the spatial concentration of other important resources such as coal, iron ore and oil, the forest resource is unique. But the forest is not only voluminous; it is also enduring. Being a renewable resource, the forest is able to perpetually serve man if managed properly. And the forest is largely sustained by drawing upon the flow resources of precipitation, carbon dioxide and sunlight, making virtually no draft on the exhaustible categories.[4]

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[1] Glesinger, p. 5.

[2] Zivnuska, p. 275.

[3] Ibid., p. 263.

[4] Hammar, Journal of Farm Economics, XXIV, p. 118.

Review of Geographic Literature Related to the Forest Resource

Nearly a century ago, the eminent geographer-scholar George Perkins Marsh wrote that geography "embraces not only the globe itself and the atmosphere which bathes it, but the living things which vegetate or move upon it, the varied influences they exert upon each other, the reciprocal action and reaction between them and the earth they inhabit."[1] Within this broad framework, Marsh viewed the forest as a major point of emphasis; in his own book, The Earth as Modified by Human Action, the chapter discussing the forest resource was the most voluminous and detailed (240 of 617 textual pages). But judging from the paucity of literature concerned with the forest resource, few geographers have followed in this tradition.

The study of resources continues to be recognized as a fruitful field for geographic investigation. In American Geography: Inventory and Prospect, an entire chapter is devoted to the geography of resources.[2] But the list of references at the end of the chapter contains no publications concerned specifically with forest resources. Other resources

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[1] George P. Marsh, The Earth as Modified by Human Action (a last revision of Man and Nature) (New York: Charles Scribner's Sons, 1907), p. 55.

[2] Preston B. James and Clarence F. Jones (eds.), American Geography: Inventory and Prospect, published for the Association of American Geographers (Syracuse: Syracuse University Press, 1954), pp. 226-39.

have attracted the attention and stimulated the curiosity of geographers. The spatially concentrated (and therefore more unique) fund resources such as coal, oil and iron ore have been explored in numerous articles, papers and books.

This is not to say that a geographic literature concerning the forest resource does not exist. In the past two decades, a number of papers investigating diverse features of the forest resource have appeared in the professional journals. In an attempt to discern some directions of thought and patterns of orientation among these articles, a simplified topical classification was devised. Listed in the order of the number of references discovered for each, the categories established are: (1) ecological and biotic, (2) economic, (3) policy and potential, (4) regional and (5) cultural. Several of the articles overlap these categories and were arbitrarily typed for the purposes of this discussion.

If number of references is indicative, geographers investigating the forest resource are partial to problems regarding the role of trees in the balance of nature and the physical site conditions of forest areas. This essentially ecological approach was pursued by Miller,[1] Bruce and

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[1]David H. Miller, "The Influence of Open Pine Forest on Daytime Temperature in the Sierra Nevada," Geographical Review, XLVI (April, 1956), pp. 209-18.

Court,[1] DeLaubenfels,[2] Hare,[3] Kuchler[4] and Thompson.[5] A related biotic study concerning chestnut blight was conducted by Zimmerman.[6] A common question in several of these studies pertained to the reciprocal influence of a forest area and its immediate surroundings.

The papers placed in the economic category concentrated on the study of forest product industries. They included studies of the pulp and paper industry by Anderson,[7]

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[1]David Bruce and Arnold Court, "Trees for the Aleutians," Geographical Review, XXXV (July, 1945), pp. 418-23.

[2]David J. DeLaubenfels, "The Status of 'Conifers' in Vegetation Classifications," Annals of the Association of American Geographers, XLVII (June, 1957), pp. 145-49.

[3]F. Kenneth Hare, "Climate and Zonal Divisions of the Boreal Forest Formation in Eastern Canada," Geographical Review, XL (October, 1950), pp. 615-35.

[4]A. W. Kuchler, "The Broadleaf Deciduous Forests of the Pacific Northwest," Annals of the Association of American Geographers, XXXVI (June, 1946), pp. 122-47.

[5]Kenneth Thompson, "Riparian Forests of the Sacramento Valley, California," Annals of the Association of American Geographers, LI (September, 1961), pp. 294-315.

[6]Robert C. Zimmerman, "Chestnut Blight in the Forests of Southern Switzerland," Geographical Review, LV (January, 1965), pp. 99-104.

[7]Sven A. Anderson, "Trends in the Pulp and Paper Industry," Economic Geography, XVIII (April, 1942), pp. 195-202.

Prunty,[1] Rodgers[2] and Terrell.[3] Parsons[4] examined the Iberian cork industry. These are essentially industrial studies and deal little with the economic character of the forest resource itself. Policy studies include Hamill's[5] brief sketch of the role of public relations in influencing forest land use decisions and Coppock's[6] descriptive analysis of post-war forestland policy in Britain. In his detailed investigation of world forest productivity, Paterson[7] developed original techniques to estimate and cartographically represent world potentials. Rostlund[8] presents a brief

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[1]Merle Prunty, Jr., "Recent Expansions in the Southern Pulp-Paper Industries," Economic Geography, XXXII (January, 1956), pp. 51-57.

[2]Allan Rodgers, "Changing Locational Patterns in the Soviet Pulp and Paper Industry," Annals of the Association of American Geographers, XLV (March, 1955), pp. 85-104.

[3]R. Paul Terrell, "The Wood Pulp Industry of the Southeast," Abstracts, Annals of the Association of American Geographers, XLII (September, 1952), pp. 255-56.

[4]James J. Parsons, "The Cork Oak Forests and the Evolution of the Cork Industry in Southern Spain and Portugal," Economic Geography, XXXVIII (July, 1962), pp. 195-214.

[5]Louis Hamill, "Public Relations Programs and Forest Land Use," Geographical Review, LIII (July, 1963), pp. 459-61.

[6]J. T. Coppock, "A Decade of Post-War Forestry in Great Britain," Economic Geography, XXXVI (April, 1960), pp. 127-38.

[7]Sten Sture Paterson, The Forest Area of the World and Its Potential Productivity (Sweden: Department of Geography, The Royal University of Goteborg, 1956).

[8]Erhard Rostlund, "Potential Productivity of the World's Forests," Geographical Review, XLIX (April, 1959), pp. 273-75.

commentary on the status of research concerning world forest potentials.

The authors of the regional studies described the magnitude, patterns and potentials of forest resources in selected areas. Raup[1] formulated a program for utilizing the forest gardens along the Alaskan Highway, Williams[2] described the character and uses of the forest resource in Venezuela's Caura Valley and Haggett[3] examined the forest patterns of South East Brazil. Studies investigating the cultural landscape produced by forest exploitation or the perception of forested areas by settlers were conducted by Stokes,[4] Wood[5] and Prunty.[6]

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[1]Hugh M. Raup, "Forest and Gardens along the Alaska Highway," Geographical Review, XXXV (January, 1945), pp. 22-48.

[2]Llewelyn Williams, "The Caura Valley and Its Forests," Geographical Review, XXXI (July, 1941), pp. 414-29.

[3]Peter Haggett, "Regional and Local Components in the Distribution of Forested Areas in South East Brazil: A Multi-variate Approach," Geographical Journal, CXXX (September, 1964), pp. 365-80.

[4]George A. Stokes, "Lumbering and Western Louisiana Cultural Landscapes," Annals of the Association of American Geographers, XLVII (September, 1957), pp. 250-66.

[5]J. David Wood, "The Woodland-Oak Plains Transition Zone in the Settlement of Western Upper Canada," The Canadian Geographer, V (Spring, 1961), pp. 43-47.

[6]Merle Prunty, Jr., "The Woodland Plantation as a Contemporary Occupance Type in the South," Geographical Review, LIII (January, 1963), pp. 1-21.

With the exception of the studies by Terrell, Wood, Haggett and Prunty, the authors reviewed emphasized ecology, forest economics and industrial geography in their investigations of the forest resource. Some thirty years ago, Zimmermann called for a functional approach to the study of resources,[1] but few contemporary studies of the forest have been functional, and many lack a spatial perspective. Other than the broad generalizations incorporated in the forest industry chapter of introductory economic geography textbooks, the relationships between utilization of the renewable forest resource and the dynamics of spatial structure have largely been ignored.

Part 2. A Geographic Approach to Resource Problems

Some Useful Generalizations

Research in geography often considers various features of the relationship between man and his environment. Of the many approaches to this vital relationship, one of the most rewarding is the study of the activities which man pursues, using the materials of his environment to which he has attached value, to sustain his existence and develop his economic well-being. Use of the geographic method provides gainful insight into this relationship between resources and economic activity. By viewing the relationships of man's

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[1]Erich W. Zimmermann, p. 1.

organization of activity in space to the exploitation of resources, problems regarding the value and quality of various resources are probed to provide a better understanding of man's utilization of his environment. Examination of the processes by which spatial expression of forest resource exploitation operates in Western society yields useful insight concerning the character of the resource as a part of man's total environment. Unfortunately, this is a problem area that has not been given much attention by geographers.

In geography there exists no specific body of theory designed to facilitate inquiry into the behavior of this relationship between man and resources. Fortunately, the study of resources is bounded by no disciplinary lines; generalizations established to examine other phenomena are often applicable. There exist in the literature of geography, resource development, economics and forestry a number of concepts which offer assistance to an investigation of forest utilization. It is worthwhile to review three of the generalizations that are pertinent to this study.

(1) As a resource, the forest is relative in the time, space and cultural dimensions. The mere physical existence of the forest assumes no association with man. Until man appropriates the forest for his use, it is not a resource. And in the past the forest has been viewed both as a resource and as a barrier. Before any statements concerning the relationship between the forest resource and a society's pattern

of activity can be made, it is necessary to understand how the forest is perceived by the society and what technological skills are possessed by the society to enable utilization of the forest.

(2) Because of the wide diversity of uses of the forest resource through modern Western technology, it has been referred to as the "universal" resource. As the forest is exploited for such divergent uses as food, fibre and building material, its utilization enters into many of man's activities.

(3) Being a biological resource, the forest is renewable. But a society can treat its forest resource as a mine or a crop. If mined, the forest can be removed from the landscape and cease production. If managed for continuous production, the forest can provide a persisting contribution to man's economic and social activities.

From a review of these generalizations, it is evident that the forest resource possesses the potential of contributing significantly to man's activities in Western society. But to examine the character of the relationship between man's arrangement of his activities and the forest resource, it is necessary to link the method by which the forest is perceived with the mechanism by which activities are organized in space. In Western society, the operational method of identifying the why, where and when of resource utilization is the principle of comparative advantage.

A characteristic of our society is the specialization of economic activity. Each individual performs a single task or a limited number of related tasks to support his livelihood. Within each commercial establishment, employees collectively produce a service or product or a limited number of functionally related services and products.[1] Expressed spatially, each center of economic activity produces a surplus of several products and services and purchases the other products and services desired. The mechanism through which the goods and services are spatially allocated is found in the principle of comparative advantage.[2]

According to this principle, a commodity or service is produced at the location or locations where their production is relatively profitable in order to serve those locations where their production is relatively unprofitable. In Western society, this tenet is used to explain decisions regarding the time and place of resource utilization. Applied to the forest resource, the principle reads: Exploitation of the forest resource will occur at those locations which permit the most profitable production of the desired goods and services provided by the resource.

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[1] Renne, pp. 142-43.

[2] Ibid., p. 142.

Statement of the Problem

Though it is recognized that exploitation of the forest resource influences the character of the evolving spatial pattern of a forested region, little is known about the operation of this process. It is hypothesized that the character of the relationship between the utilization of a forest resource and the organization of human activity in space is a function of the method by which the resource is appropriated for use. In order to examine the validity of this statement, the exploitation of forest resources is conceptually divided into two sequences, each of which expresses a unique quality of relationship between the resource and human activity.[1]

In one sequence, the forest is removed in its entirety from the landscape (mined) to satisfy the demands of the inhabitants for forest products or cleared land. The role of forest utilization in man's arrangement of activities is terminated when the region is denuded.

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[1]For an informative discussion of sequences of resource utilization, see J. R. Whitaker, "Sequence and Equilibrium in Destruction and Conservation of Natural Resources," Annals of the Association of American Geographers, XXXI (June, 1941), pp. 129-44.

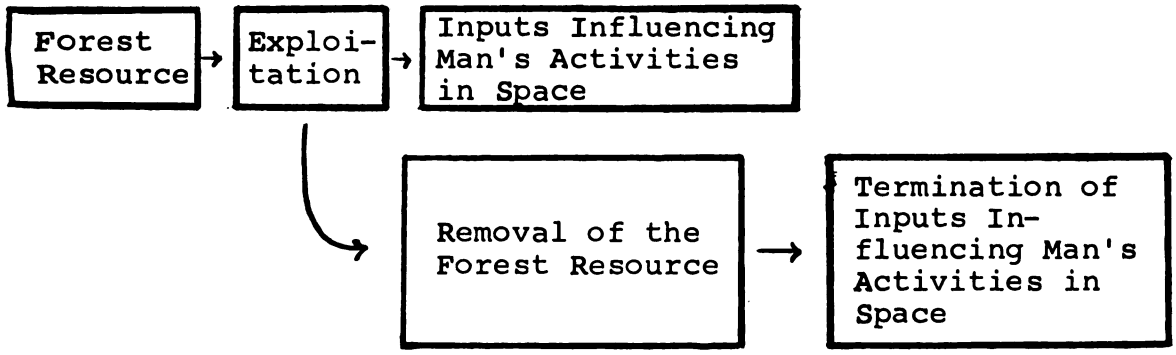

Figure 1.--Model for sequence of forest removal

In the other sequence, the forest is managed for continuous production, thereby supporting forest production industries through time. Here, the exploitation of the resource makes a persisting contribution to the character of the evolving spatial structure.

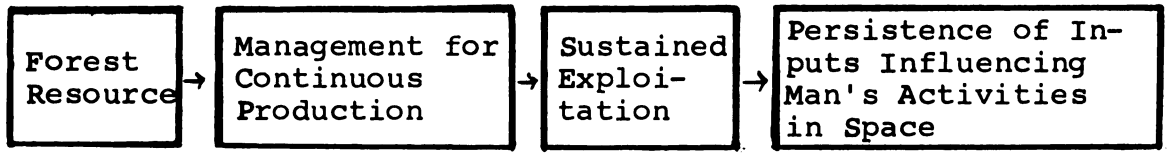

Figure 2.--Model for sequence of managed resource

As the purpose of this study is to investigate the role of forest exploitation as an agent in formulating the spatial structure of a region, the behavior of forest product industries in a forested area must be observed. The industries serve as a morphological connection between the concept of forest utilization and the physical organization of economic activity in space. In this thesis, the evolution

of the forest product industries in Northern Michigan is investigated. Forming the framework of analysis is the study of the mining of the forest to support the lumber industry between 1850 and 1910 and the expansion of the pulp and paper industry based on the managed second-growth forest since World War II.

Because of the economic and structural importance of the persisting benefits realized in the sequence predicated on forest management, this pattern of forest utilization is more fully developed through a detailed examination of the Northern Michigan pulp and paper industry. In approaching the persisting influence of a managed resource, consideration is given the notion that the structural organization of the exploitation of the resource, and consequently the potential of the resource to influence the human arrangement of activity in a region, is in large measure determined by the comparative advantage of the area for forest product industries. Therefore, in exploring the enduring quality of the relationship between the utilization of a managed forest resource and human activity, the following substantive secondary hypothesis is investigated. It is postulated that based on the local timber supply managed for continuous production, Northern Michigan enjoys certain advantages for the pulp and paper industry which promote a persisting contribution of the forest resource to the arrangement of human activity within the region.

Scope of the Investigation

To permit more intensive examination of the processes under investigation, this study is restricted both spatially and topically. Although there are now, and have been in the past, a number of forest product industries which could be supported by the Northern Michigan forest resource, detailed examination is confined to the lumbering industry, which dominated the early phases of forest exploitation, and the pulp and paper industry, which presently is dominant. A functional approach, stressing the forms of the patterns resulting from the exploitation, with primary emphasis on the elements which support an enduring contribution to the regional economy, constitutes the direction of study. The structural arrangements stressed are those related to the organization of activities which produce goods and services, the economic pattern. The dynamics of economic growth and development serve as the structural expression of shifts in the form of forest exploitation and as a measure of the persistence and changes in the organization of activities resulting from the renewable quality of the managed resource.

Sources of Data

Much of the data in this study relevant to the pulp and paper industry, the policies and practices of forest management and exploitation, and the relative advantage of Northern Michigan for the pulp industry were acquired through

discussions with officials of the pulp companies operating in the Lower Peninsula. A list of questions (see Appendix I) concerning the forest resource and the pulp industry was devised and sent to the mill managers of the five mills and one particle board plant presently exploiting the Northern Michigan forest resource. A cover letter described the purpose of this study and requested an interview to discuss the list of questions and other pertinent topics. Interviews were conducted with the mill managers, usually vice-presidents of the parent corporations, and wood procurement officials of each of the companies. Much of the data collected from these inquiries is confidential and cannot be associated with the individual mills. Because of the guarantee of confidence, the mill managers were favorably disposed to cooperate fully.

Other data were obtained through personal contacts with officials in the Michigan Department of Conservation, Forestry Division, and the Michigan Department of Economic Expansion. Forest economists in the Conservation Department made available files containing needed information regarding management and utilization practices and the character of the Northern Michigan forest resource. The Department of Economic Expansion afforded access to their records regarding the economic structure and developmental activity in the region of study.

Periodic correspondence with forest economists and foresters at the North Central Forest Experiment Station at St. Paul, Minnesota, and the Forest Products Laboratory at Madison, Wisconsin, provided valuable data concerning forest management practices, forest volume and economic considerations of forest utilization in Northern Michigan. Additional data regarding the overall economic structure and forest resource exploitation within the region were procured through a discussion with officials of the Center for Economic Expansion and Technical Assistance at Central Michigan University.

The science and art of forestry and forest utilization were detailed to the writer by faculty members from the Departments of Forestry and Forest Products at this university. A similar explanation of the economics of forest utilization and the pulp and paper industry was provided by Dr. Benjamin Slatin of the American Paper Institute. The literature relevant to the study was researched at the Michigan State University Library, the State Library of Michigan and the Michigan Historical Commission Archives.

Area of Study: Northern Michigan

The area of study selected encompasses the northern thirty-one counties of Michigan's lower peninsula, which constitute the Northern Lower Peninsula Forest Survey District of the U.S. Forest Service (see Figure 3). Preference for

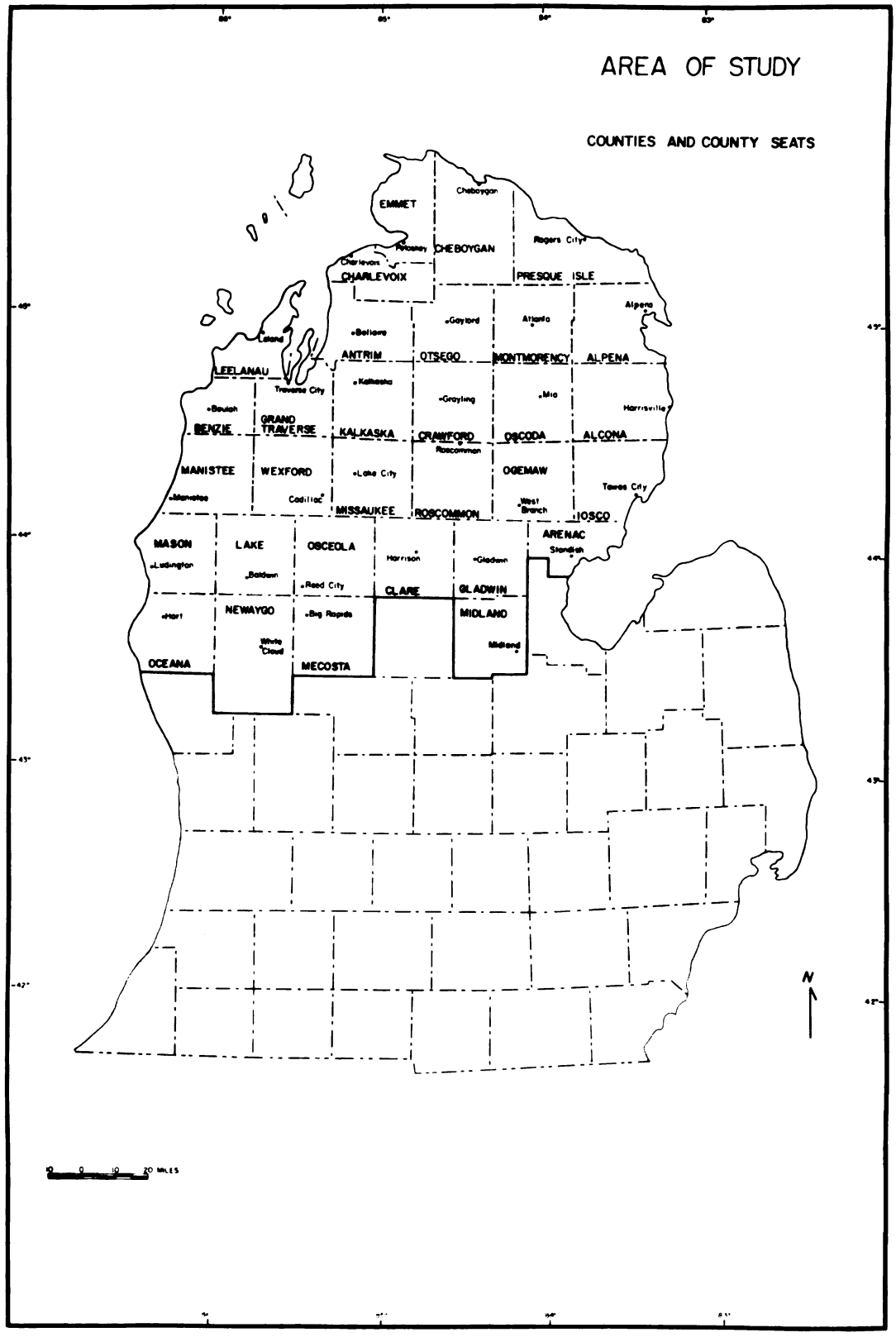
AREA OF STUDY
COUNTIES AND COUNTY SEATS
EMMET
Cheboygan
CHEBOYGAN
Rogers City
CHARLEVOIX
PRESQUE ISLE
Alpena
Gaylord
Atlanta
ANTRIM
OTSEGO
MONTMORENCY
ALPENA
LEELANAU
Traverse City
Kalkaska
Grayling
Mio
Harrisville
Beulah
BENZIE
GRAND TRAVERSE
KALKASKA
CRAWFORD
Roscommon
OSCODA
ALCONA
MANISTEE
WEXFORD
Lake City
OGEMAW
Tawas City
Manistee
Cadillac
West Branch
MISSAUKEE
ROSCOMMON
IOSCO
ARENAC
Standish
MASON
LAKE
OSCEOLA
Harrison
Gladwin
Ludington
Baldwin
Reed City
CLARE
GLADWIN
NEWAYGO
Big Rapids
MIDLAND
Hart
White Cloud
Midland
OCEANA
MECOSTA
N
10 0 10 20 MILES

Figure 3

this boundary arises from the availability of useful Forest Service data based on this division. Also, this boundary approximates the Bay City-Muskegon "line" commonly drawn by investigators desiring to separate the differing economic patterns of Northern and Southern Michigan. As defined in this study, Northern Michigan extends over 16,775 square miles, an area larger than that of Massachusetts, Connecticut and Rhode Island combined.

Northern Michigan affords an excellent example of a forest-based economy and has had an economic history similar to that of other forest regions in the Midwest, South and Far West. With 29% of Michigan's land area, the region accounts for 40% of the state's forested land and a significant proportion of the forest product industries. Economically and socially, the history of the region is based on the exploitation of the forest resource. The initial occupance of the region for settlement was for the purpose of exploiting the forest, and today the forestry and forest product industries probably constitute the most important sectors of the regional economy.[1]

The writer has a long association with Northern Michigan as a vacation abode, as the home of part of his

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[1]This opinion is shared by officials in the Michigan Conservation Department and the Department of Economic Expansion. Of course, no precise measurement of the relative import of the forest industry and the tourist industry is available to support the claim.

family, and through the ownership of property in Otsego County. As a student of the region, two papers have been prepared considering developmental aspects within the area.[1] It is through these travels, family contacts and previous research that the writer became acquainted with the economy and forest resource of Northern Michigan.

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[1]David E. Kromm, "The Gaylord Industrial Development Corporation: A Study in Community Resource Development," unpublished research paper, Michigan State University, March 2, 1965, and David E. Kromm, "Summary Statements on the Nature of Community Resource Development in Northern Michigan," unpublished research paper, Michigan State University, September, 1965.

CHAPTER II

MINING OF THE NORTHERN MICHIGAN FOREST RESOURCE

Introduction

In the first model of forest exploitation conceptualized earlier in this study, the resource is removed from the landscape much as coal or iron ore is mined. The timber is "mined" in that it is cut with no provisions being made to insure continued growth. In the early stages of this sequence, the economy of the region experiences growth with the addition of logging camps, wood processing mills and the influx of people to man and support the primary activities. As long as the forest exploitation progresses, structural elements within the region are continuously changed because of the increased economic inputs resulting from the expanding conversion of the resource. But in this model, the timber is physically removed, and the economic support provided by the resource terminates. The arrangement of activities is altered as new means of support are sought, and the inputs from the exploitation of the forest decline and then end.

The exploitation of the forest resource of Northern Michigan to support the demands of the lumber industry during the second half of the nineteenth century affords an opportunity to observe the processes and structural changes involved in the mining of a forest resource. Investigation of the historical process of removing the Northern Michigan forest resource provides useful insight into the structural relationships between forest and man in the mining of the resource. The chapter begins with a brief overview of the pre-mining relationship between forest and man in Northern Michigan.

Early Non-Commercial Utilization of the Forest

Prior to the settlement of Northern Michigan for the express purpose of harvesting the forest resource, man had long lived in harmony with the trees. Only one hundred and twenty-five years ago, the entire region was covered with a timber resource virtually unaltered by man. The most widely distributed tree of the original forest resource was northern white pine. Usually, the white pine occurred with hardwoods such as maple, beech, yellow birch, elm, basswood and white ash. Hardwoods predominated on the better upland soils, often in a mixture with hemlock and scattered pine, while on the dry, sandy soils, the white pine was replaced by dense,

pure stands of jack pine or open stands of Norway (red) pine[1] (see Figure 4).

This forest remained unchanged by the activities of the sparse Indian population and the early French settlers. Although Nicolet explored the coastal areas of Northern Michigan as early as 1634, the French were interested more in furs and the souls of the Indians than the trees. The French did build a sawmill near the present site of Port Huron as early as 1749, but this and other primitive mills only provided lumber for the construction of a few scattered small forts and missions. The population remained meager during the political control of both the French and the British; significant settlement did not take place in any part of Michigan prior to the third decade of the nineteenth century.

A local demand for lumber developed in Southern Michigan with the rapid settlement of the region following the completion of the Erie Canal in 1825. Most of the early sawmills were small and supplied a limited local market; sometimes these mills operated in conjunction with a grist mill and served as nuclei for settlement. Using Mumford's classification of West European cultural evolution, this was

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[1]William N. Sparhawk and Warren D. Brush, The Economic Aspects of Forest Destruction in Northern Michigan, U.S. Department of Agriculture Technical Bulletin No. 92 (Washington: U.S. Government Printing Office, 1929), p. 4.

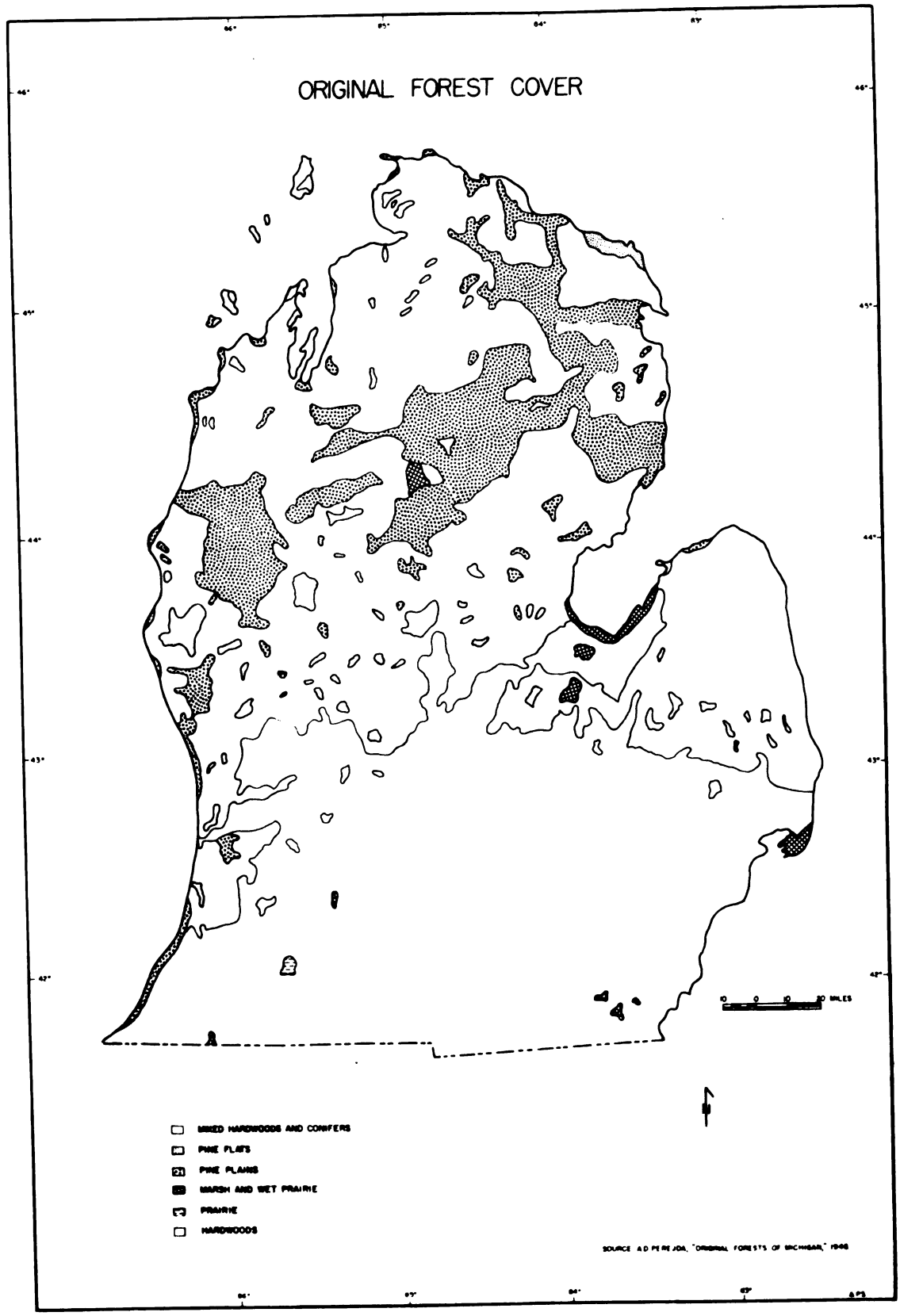
ORIGINAL FOREST COVER
MIXED HARDWOODS AND CONIFERS
PINE FLATS
PINE PLAINS
MARSH AND WET PRAIRIE
PRAIRIE
HARDWOODS

Figure 4

the eotechnic phase of the wood industry in Michigan.[1] During this period, simple engines harnessed water power to operate small individual or community sawmills. Chiefly basswoods and yellow poplar were cut, as they were light and easy to work with for general building purposes.[2]

These sawmills, often individually operated by farmers, yielded to larger commercial mills when a sizeable demand for lumber was created by increased settlement and the depletion of the forest resources of the Northeast. The Erie Canal facilitated this expansion by providing a route to bring the new settlers into Michigan and to export the lumber to the East. With the growth of a large accessible market for Michigan timber, the paleotechnic phase of commercial lumbering was ushered in with the construction of a number of steam-driven sawmills. Steam mills were built as early as 1832 in Detroit and Port Huron and at Saginaw and Muskegon in 1837.[3] Because of these technological innovations, the character of resource utilization was to rapidly change.

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[1]Lewis Mumford identified three overlapping and interpenetrating phases of Western cultural evolution, each forming a distinctive technological complex. The eotechnic phase is characterized by a wood, wind and water power complex; the paleotechnic by a coal, steam and iron complex; and the neotechnic by such advanced features as synthetics and electricity. Lewis Mumford, Technics and Civilization (New York: Harcourt, Brace, and Company, Inc., 1934), p. 109.

[2]Sparhawk and Brush, p. 6.

[3]Carl A. Leach, "Paul Bunyan's Land and the First Sawmills of Michigan," Michigan History Magazine, XX (Winter, 1936), pp. 73, 75 and 82.

With more than 3,000 square miles of white pine threaded by a series of rivers, the Saginaw Valley soon became the sawmilling center of the state. Because of the large out-of-state market created for lumber in the Northeast and by the rapid settlement of the prairie states, the Saginaw concentration grew rapidly. By 1854, sixty-one sawmills were in operation, twenty-nine of which had a capacity exceeding 100,000,000 board feet annually.[1] Eastern capital and lumbermen flowed to Michigan from the depleted forests of the Northeast, and a second major sawmilling center arose at Muskegon. The first mill to tap the great pine resources of the Muskegon River Valley was built at Muskegon in 1837. As these and other mills depleted the southerly zone of the white pine, the lumbermen moved into Northern Michigan.

Mining of the Forest Resource

> It is said that the pine of Michigan made more millionaires than the gold of California.[2]

Although there were twenty-one sawmills employing 364 people in Northern Michigan as early as 1854,[3] large-scale

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[1]Willis F. Dunbar, Michigan: A History of the Wolverine State (Grand Rapids: William B. Eerdmans Publishing Company, 1965), p. 471.

[2]Charles M. Davis, "The High Plains of Michigan" (unpublished Ph.D. dissertation, Department of Geography, University of Michigan, 1935), p. 68.

[3]Census and Statistics of the State of Michigan: May, 1854 (Lansing: Geo. W. Peck, Printer to the State, 1854).

development of the lumber industry occurred after 1860. The initial pattern of development centered where rivers flowed into one of the Great Lakes and at the southern edge of the pine zones near the agricultural lands of Southern Michigan. The rivers "served both as a pipeline for raw materials and as a harbor for lake vessels on which to ship the finished product."[1] In this manner, major sawmilling centers arose in Alpena, Grand Traverse, Manistee, and Oceana Counties by 1864, and in Alcona, Cheboygan, Iosco, Mason, Mecosta, Newaygo, Osceola and Wexford Counties by 1874 (see Figure 5). According to Powers, in 1868 Alpena alone had 19 sawmills which produced 85,355,872 board feet of lumber and employed 772 men.[2]

Because of the availability of the white pine and the increasing market for lumber, sawmilling grew rapidly in Northern Michigan. The white pine was an excellent wood; soft, easily worked and light of weight, it was long-lasting and provided a high amount of lumber from each tree. Large, pure stands of this tree were massed throughout the region. Markets expanded as the treeless prairie states were settled and as great urban centers such as Chicago grew. Much of

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[1]William G. Rector, "Railroad Logging in the Lake States," Michigan History, XXXVI (December, 1952), p. 352.

[2]Perry F. Powers, A History of Michigan and Its People, Volume I (Chicago: The Lewis Publishing Company, 1912), pp. 192-206.

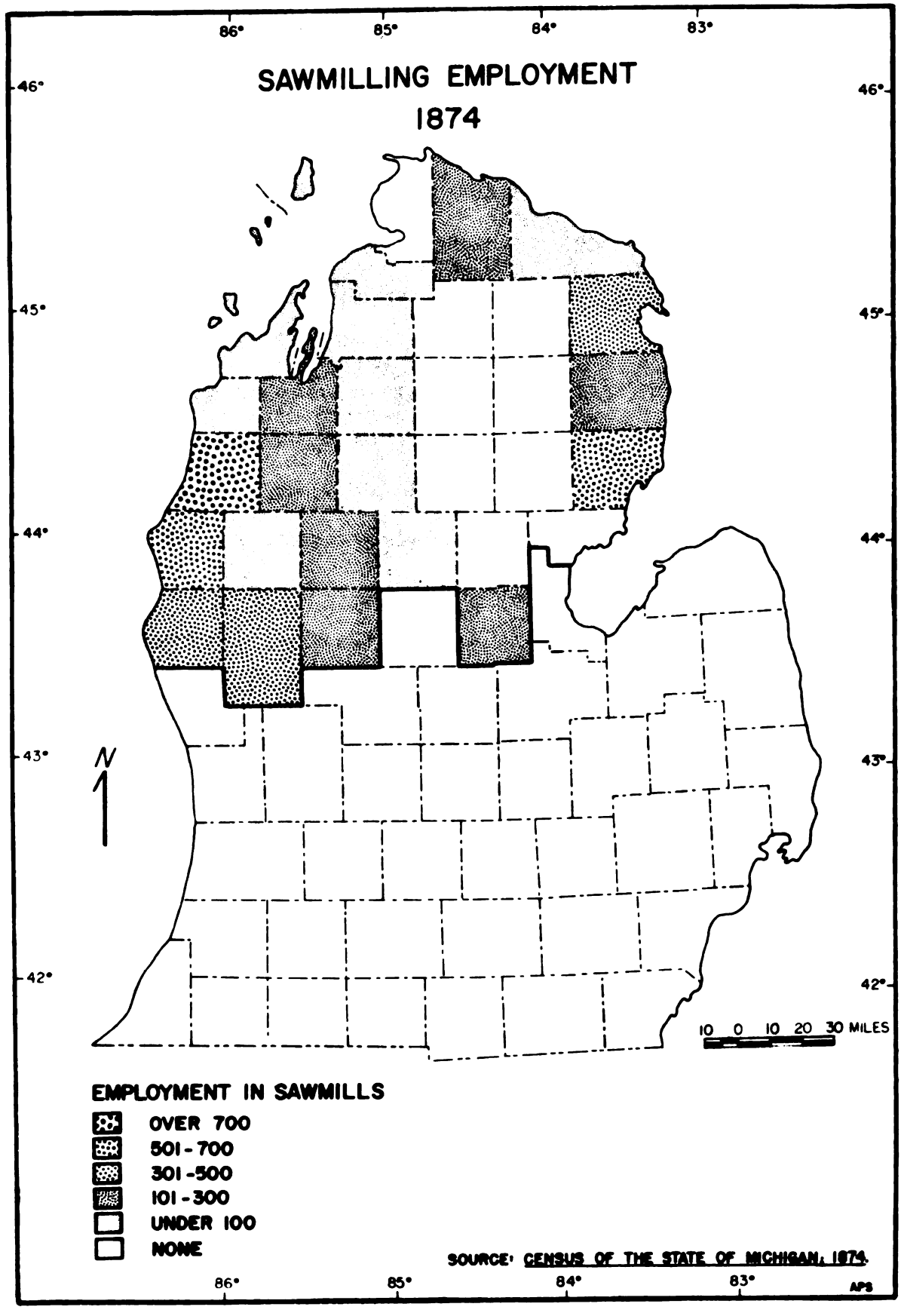
SAWMILLING EMPLOYMENT
1874
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
EMPLOYMENT IN SAWMILLS
OVER 700
501-700
301-500
101-300
UNDER 100
NONE
SOURCE: CENSUS OF THE STATE OF MICHIGAN, 1874.
APS

Figure 5

the timber demand of these growing areas was satisfied in Northern Michigan. For thirty years, 1860-1890, Michigan was to lead the nation in lumber produced.

Throughout the 1860's and most of the 1870's, only the forests near the streams were tapped, as the vast forest of the interfluves could not be reached by the existing logging methods. The development of the lumber industry had brought the paleotechnic railroad to Northern Michigan, but it was being used only to ship lumber out of the region and to bring supplies and men in. By 1877, more than half of the sawmills and woodworking establishments in Michigan were located along nine different railroad lines.[1] But in spite of these interregional ties, the logs themselves were still moved by eotechnic methods such as sleighing, skidding and driving. Logging railroads had been constructed as early as 1852 in New York but had never gained wide acceptance because adequate timber was always available near the streams; also, the lumbermen preferred to invest capital in undeveloped forest areas rather than intensifying the exploitation of established operations.

The most significant innovation in the exploitation of the Northern Michigan forest resource during the mining sequence was the development of the logging railroad. During

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[1]William G. Rector, Log Transportation in the Lake States Lumber Industry, 1840-1918 (Glendale, California: The Arthur H. Clark Company, 1953), p. 194.

the winter of 1876-77, many lumber companies were unable to move their timber to the rivers because of the lack of snow. To transport his logs to the Muskegon River, a Clare County lumberman built a seven-mile railroad to his lumber camp.[1] His venture was successful and the idea diffused rapidly. Within two years, the logging railroad had become the accepted method of transporting timber.

The logging railroad revolutionized the lumber industry and had a profound effect on the spatial distribution of the lumbering operations. Railroads facilitated the exploitation of forest previously inaccessible and the utilization of species that were too dense to be floated down the rivers. The logging railroad eliminated the uncertainties of nature from the transport of logs and made lumbering into a year-round business. Investment costs rose significantly, and large concerns soon characterized the industry. New mills were built in the forested areas away from the rivers, and the interior of Northern Michigan underwent rapid settlement. By 1884, major sawmilling operations were producing lumber in nearly all the counties of the region, and important interior communities were developing at Cadillac, Grayling, Roscommon and Lake City (see Figure 6).

Facilitated by the logging railroad, the mining of the forest resource rapidly depleted the timber supply, and

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[1]Rector, Log Transportation in the Lake States Lumber Industry, 1840-1918, p. 196.

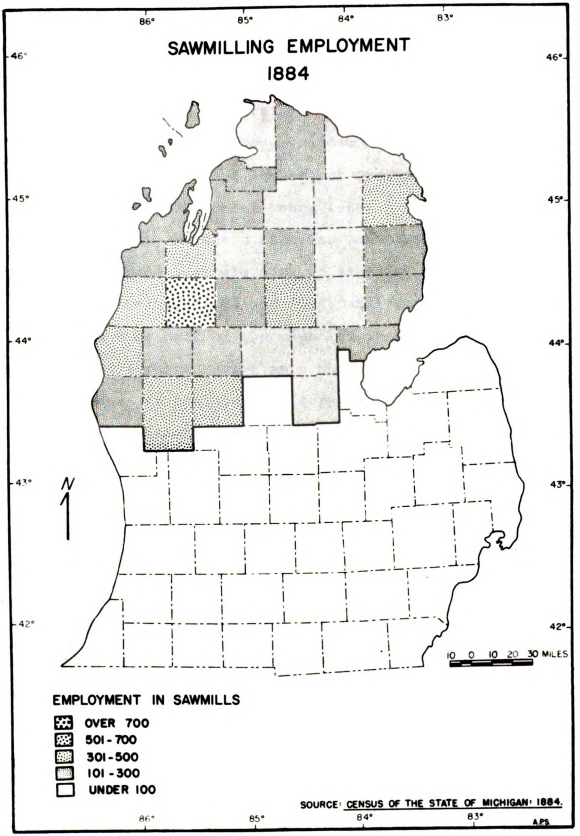
SAWMILLING EMPLOYMENT
1884
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
EMPLOYMENT IN SAWMILLS
OVER 700
501 - 700
301 - 500
101 - 300
UNDER 100
SOURCE: CENSUS OF THE STATE OF MICHIGAN: 1884.
APS

Figure 6

by 1880, much of the forest along the shores of the Great Lakes and in the southern zone of interior counties was exhausted.[1] In 1883, a shingle factory at St. Helen in Roscommon County had to move because of lack of wood. In 1890, the Oscoda Boom Company in Iosco County sawed 324,503,531 board feet of lumber but produced less than 94,000,000 board feet three years later.[2] A writer traveling through forty Northern Michigan counties in 1896 reported not seeing a single acre of standing pine in good condition.[3] Between 1884 and 1894, employment in sawmills declined in over half of the counties in Northern Michigan and probably for the region as a whole (see Figure 7).

Because of the abundant supplies of birch, beech, elm and maple that remained, the exhaustion of the white pine did not lead to an immediate collapse of the forest products industry. At East Jordan, the first sawmill for hardwoods was built in 1879, and soon after, other mills began operation at Traverse City, Ludington, Alpena, Onaway, Manistee

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[1]Ciriacy-Wantrup pointed out the long-range effects of the logging railroad in his statement that "the railroad not only hastened the disappearance of virgin timber, but hampered forest regeneration because [it] made selective cutting uneconomical, destroyed young growth, and left large fire hazards." S. V. Ciriacy-Wantrup, Resource Conservation: Economics and Policies (Berkeley: University of California Press, 1952), p. 5.

[2]Edna M. Otis, Their Yesterdays: Au Sable and Oscoda, 1848-1948.

[3]Sparhawk and Brush, p. 8.

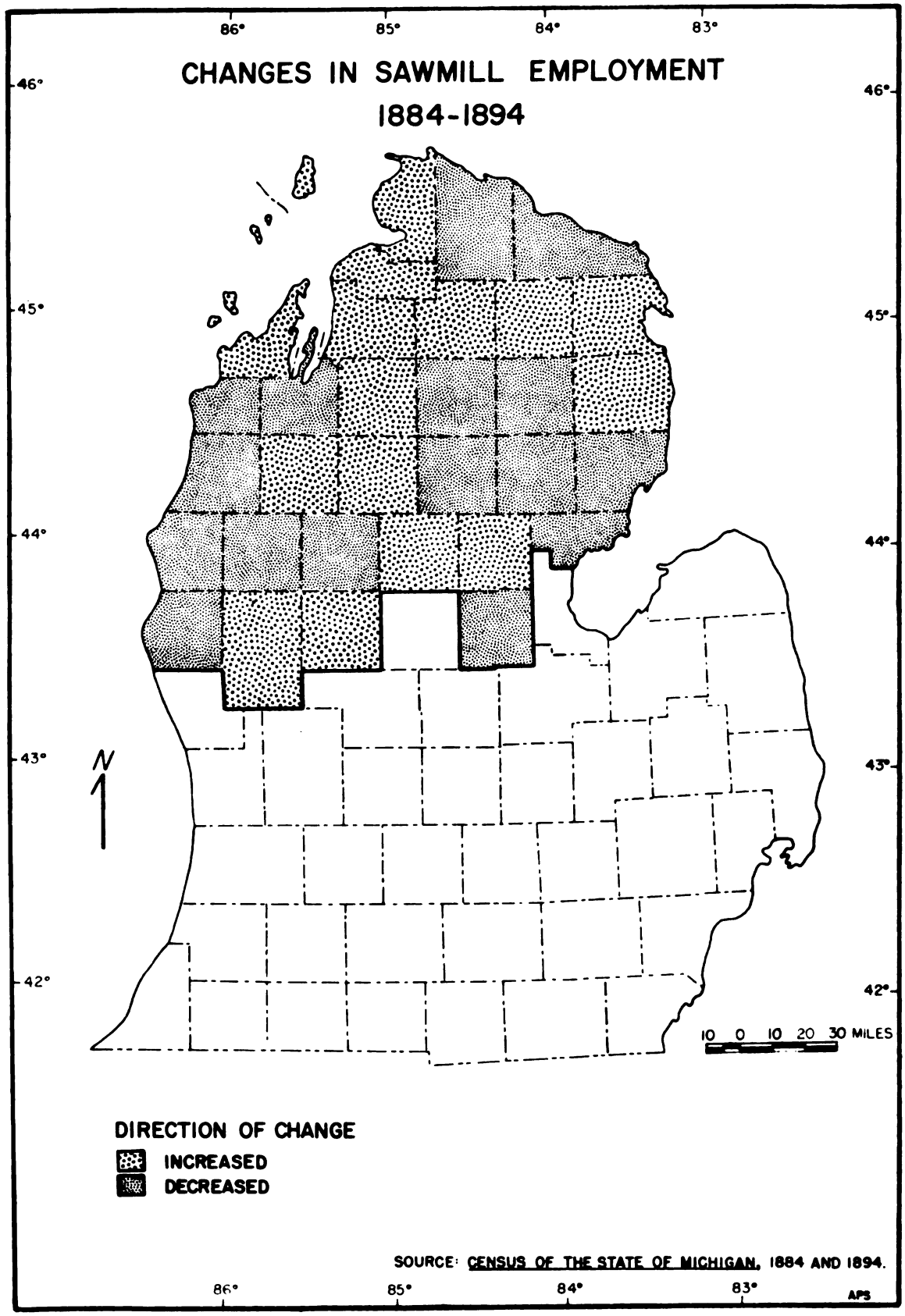
CHANGES IN SAWMILL EMPLOYMENT
1884-1894
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
DIRECTION OF CHANGE
INCREASED
DECREASED
SOURCE: CENSUS OF THE STATE OF MICHIGAN, 1884 AND 1894.
APS

Figure 7

and a number of other white pine sawmilling centers. By 1909, the state of Michigan produced 59% of the maple in the United States, cutting 543,214,000 board feet valued at $8,664,263.[1]

Growth of Other Forest Product Industries

Despite the availability of timber, only a limited forest products processing industry developed during the mining era. This is probably due to the fact that these industries, unlike logging and milling, required plentiful skilled labor, large capital investment relative to the return and a nearby market. Those wood products which were manufactured were usually by-products of the lumbering industry such as shingles, fuelwood, fence posts and utility poles. The most common of these enterprises was the shingle factory, which used residue from the sawmills and was often operated in conjunction with a sawmill. Most of the larger lumbering centers supported a shingle mill, and as early as 1874, Northern Michigan accounted for over one-third of the value added by manufacture in the shingle industry for the entire state. As seen in Table 1, the fortunes of the shingle industry closely paralleled those of the lumber industry.

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[1] Powers, p. 213.

Table 1.--Growth in number and employment of shingle mills, 1874-1894.[a]

Year	Number		Number	
	Michigan	Northern Michigan	Michigan	Northern Michigan
1874	223	66	2,591	865
1884	228	115	4,305	2,076
1894	167	111	2,878	--

[a]Michigan, Census of the State of Michigan: 1874, compiled and published by the Secretary of State (Lansing: W. S. George and Company, State Printers and Binders, 1875); Michigan, Census of the State of Michigan: 1884, Vol. II: Agriculture and Manufactories, compiled and published by the Secretary of State (Lansing: Thorp and Godfrey, State Printers and Binders, 1886); and Michigan, Census of the State of Michigan: 1894, Vol. II: Agriculture, Manufactories, Mines, and Fisheries, compiled by the Secretary of State (Lansing: Robert Smith and Company, Printer and Binder, 1896).

The shingle mills moved northward and into the interior of Northern Michigan on the coattails of the sawmills. The decline of the shingle industry in the southern tier of counties of the region demonstrates this point. In 1874, these four counties accounted for 65% of the shingle mills in Northern Michigan; this proportion dropped to 40% in 1884 and a mere 22% in 1894. Conversely, the interior counties--Crawford, Kalkaska, Missaukee, Ogemaw, Osceola and Clare--

which had only six shingle mills in 1874, were supporting thirty in 1894.[1]

A less ubiquitous enterprise was the planing mill, which shaped the lumber into various semi-finished and finished products. Being more market-oriented, planing mills were usually found only in the larger sawmilling centers. In 1874, the cities of Alpena, Manistee and Big Rapids accounted for eight of the region's twenty-two planing mills. And in 1894, planing mills with sash, door and blind factories combined were concentrated in the populous counties of Alpena, Iosco, Manistee, Mecosta, Oceana and Wexford. Together, these six counties accounted for twenty of the region's thirty-eight planing mills.[2]

The furniture industry was poorly developed during the white pine era but grew to modest proportions during the subsequent exploitation of the hardwood forest. The wagon and wagon woodwork factories were also based on the hardwood forest and only of local importance. Other wood product industries found in Northern Michigan, such as cooperages (barrel makers), box factories and stave, heading and coiled hoop mills, utilized small-dimension materials. Only the

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[1] Census of the State of Michigan: 1874; Census of the State of Michigan: 1884, Vol. II: Agriculture and Manufactories; and Census of the State of Michigan: 1894, Vol. II: Agriculture, Manufactories, Mines, and Fisheries.

[2] Ibid., 1874 and 1884.

stave mills were well developed, with the region accounting for over one-third of the state total in 1894.

Table 2.--Number of plants, employment and capital invested for selected industries, 1884.[a]

Industry	Number of Plants	Number Employed	Capital Invested
Wagon manufacture	69	172	$158,750
Wagon woodwork	17	34	21,525
Furniture manufacture	9	104	97,700

[a]Census of the State of Michigan: 1884, Vol. II: Agriculture and Manufactories.

Relationship of Mining to Structural Arrangements

The rapid growth of the white pine lumber industry had a profound influence on the arrangement of economic activity and the growth of the regional economy. Although the data are not strictly comparable because of changes in the classification system used between censuses, it can be seen from Table 3 that the economy of Northern Michigan was dominated by the exploitation of the timber resource during the mining phase. In 1854, the sawmills accounted for 93% of the manufacturing employment and were responsible for over one-fourth of the total as late as 1894. The total number of employees working in lumber mills grew from 364 in

Table 3.--Selected characteristics of the Northern Michigan economy, 1854-1894.[a]

	1854	1864	1874	1884	1894
Population	6,867	19,765	95,707	253,885	325,984
Percentage of state population	1.4%	2.5%	7.2%	13.7%	14.5%
Employment in manufacturing	392	1,500	7,030	27,039	25,815
Employment in sawmills	364	1,151	5,304	6,914[b]	7,288
Number of sawmills	21	58	235	314[b]	303
Board feet of lumber sawed	25,511,000	90,209,500	771,925,800	---	---
Capital invested in sawmills	---	$944,500	$6,495,100	$8,207,931[b]	$8,097,823
Value of lumber	---	$958,855	$8,801,514	---	$7,925,416

[a]Calculated from data given in Census and Statistics of the State of Michigan: May, 1854; Census and Statistics of the State of Michigan: 1864; Census of the State of Michigan: 1874; Census of the State of Michigan: 1884, Vol. II: Agriculture and Manufactories; and Census of the State of Michigan: 1894, Vol. II: Agriculture, Manufactories, Mines, and Fisheries.

[b]Data are low because of the method of reporting used in 1884.

1854 to 7,288 in 1894; it is probable that the number approached 7,500 in the peak lumbering year, 1890.

The lumber industry nourished a growing population that demanded barbers, doctors, teachers and storekeepers. Between 1854 and 1864, the population increased by 288% and by 484% between 1864 and 1874, with the rate of increase declining to 265% between 1874 and 1884. Even though nearly all of the usable softwoods were removed by 1890, the population continued to grow as the hardwood lumbering and other manufacturing and service industries expanded. Between 1884 and 1894, the population increased by only 28%. The proportion of the state population residing in the region increased with each enumeration and peaked at nearly 15% in 1894.

Counties, cities and villages were organized as the lumber industry diffused throughout the region. Prior to 1851, Northern Michigan remained politically unorganized and there existed only a handful of small fishing villages, sawmill communities and Indian settlements. The organization of the region into minor civil divisions closely followed the movement of the lumber industry. By 1859, ten coastal and southern tier counties were formed as sawmilling centers arose in their territory (see Figure 8). As the industry spread along the coast and then inland, political organization ensued. By 1869, all but thirteen inland counties and one coastal county of the present thirty-one were

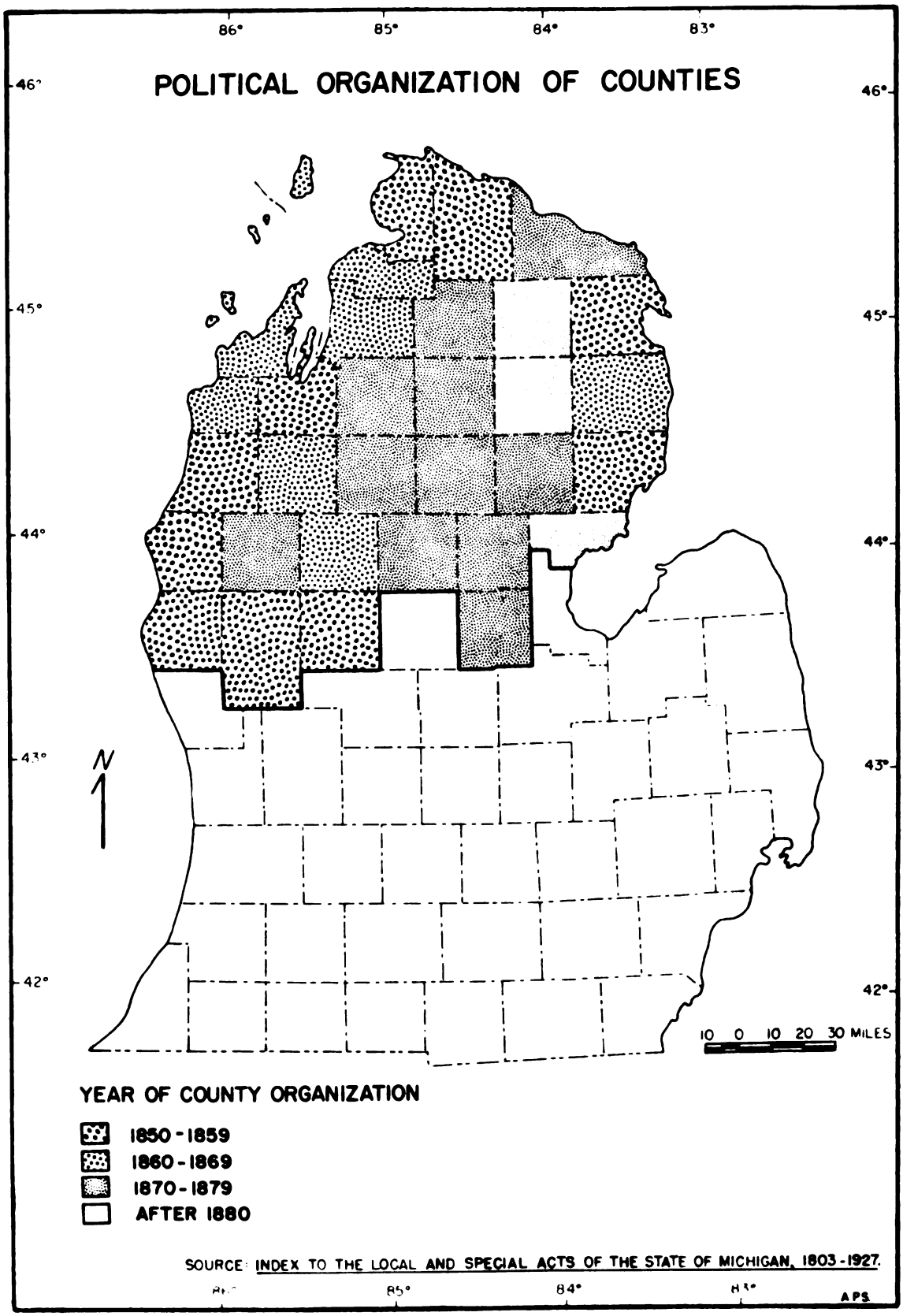
86°
85°
84°
83°
POLITICAL ORGANIZATION OF COUNTIES
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
YEAR OF COUNTY ORGANIZATION
1850-1859
1860-1869
1870-1879
AFTER 1880
SOURCE: INDEX TO THE LOCAL AND SPECIAL ACTS OF THE STATE OF MICHIGAN, 1803-1927.
APS

Figure 8

organized. Except for three counties which never supported any sizable sawmilling centers, political organization was complete by 1879.

Communications also developed with the expansion of the lumber industry. Railroads were first built to connect interior sawmilling centers with ports and with more southerly trunk lines. With the advent of the logging line, rails connected the resource with the sawmills. In 1882, forest products accounted for nearly three-fourths of all rail tonnage on a typical railroad.[1] Under a federal law to aid states in establishing rail communications, railroad companies were granted about 2,100,000 acres of forest land in Northern Michigan. During the mining of the forest, these companies constructed over 3,200 miles of railroad in the region.[2]

Agriculture developed rapidly on the thin soils as prices for produce were inflated by the increasing demands for the lumber camps and milling centers. Crops cultivated included hay and oats used as feed for the work animals in the logging camps and potatoes and wheat for human consumption. Because of the complementary work periods of

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[1]Edmund A. Calkins, "Railroads of Michigan since 1850," Michigan History Magazine, XIII (Winter, 1929), p. 18.

[2]Russell Watson, "Forest Devestation in Michigan: A Study of its Deleterious Economic Effects," Journal of Forestry, XXI (May, 1923), pp. 431 and 446.

lumbering and farming, many of the farmers worked their land May through October and then hired on at the logging camps for the cutting and driving seasons. Even at the greatest extent of agricultural development during the lumbering period, more than half the food supply was produced outside the region.

Most industries established before 1900 were wood processing plants or firms serving the timber-using factories. As stated earlier, most of the logs were sawed into timber and exported with little value being added by manufacture during the White Pine Era. However, the hardwood period saw the rise of many woodworking industries in Northern Michigan. In Cadillac were manufactured hardwood flooring and furniture, in Reed City and Alpena maple flooring and in Onaway bicycle and automobile steering wheel rims.[1] Throughout the lumbering centers, small plants turned out numerous wooden products such as baskets, wooden barrels, shingles, handles, crates, poles and lathes.

Structural Changes Resulting from Forest Depletion

Structural changes resulting from economic decline following the depletion of forest resources have been repeated throughout the United States where the resource was mined. Merriam lists the general conditions which prevail:

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[1] Powers, pp. 222 and 485.

"decline of industrial centers, injury to transportation systems, depopulation and impoverishment of extensive regions, and destruction of, or injury to, scenic features and wildlife habitats."[1] As the economic structure of Northern Michigan was initially developed and then dominated by the exploitation of the forest, the magnitude of the change following the depletion of the forest resource was particularly striking.

The most significant feature of the structural change was the loss of nearly all economic support for the population when the timber was removed. There was no transition from a forest-based economy to a diversified industrial and agricultural economy as characterized many areas previously depleted of trees. When the lumber mills left, the farmers were dealt two blows--they were unable to find winter work as loggers, and they lost their local market for grain and hay. Between 1910 and 1930, the number of farms declined by 27% as the farmers moved to the towns or left the region altogether.[2] Much has been written about this failure of the "plow to follow the axe" in Northern Michigan and the other cutover lands of the Lake States.[3] Many of the sawmill

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[1]Willis B. Merriam, "Forest Situation in the Pacific Northwest," Economic Geography, XIV (January, 1938), p. 104.

[2]Whitaker and Ackerman, pp. 230-31.

[3]Michigan, Minnesota and Wisconsin.

owners, railroad men and community commercial leaders assumed that, as soon as the timber was removed, the farmer could move in and cultivate the land. They expected that, as happened in other forested areas, the land would "ripen" into a higher use. These men were concerned about the economy, "but they were sure that farmers would appear in all the upper counties once the timber was cut."[1] In 1912, Powers wrote that the white pine of Northern Michigan is gone, "but the fruit raiser is close upon the retreating lumberman of the pineries, and even in certain sections of the hardwood country the farmer follows that class of lumberman so closely that what was this year a solid forest will next year be cleared and planted to potatoes or rye or wheat."[2] Writing about Montmorency County, Powers states the then popular belief that "any section that will grow large timber can be depended upon for agriculture and horticulture."[3]

The myth that most of the cutover land was suitable for agriculture was given credence by the activities of the logging and railroad companies that wanted to dispose of their land and the local trade and development associations

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[1] L. R. A. Schoenmann, "Public Lands in Michigan," President's Address, Michigan Academy of Science, Arts, and Letters, Report for 1951, p. 25.

[2] Powers, p. 211.

[3] Ibid., p. 486.

that wanted to find a substitute for timber to sustain the economy. Large tracts of land were sold by the companies in vast real estate schemes, and community and regional organizations[1] such as the Western Michigan Development Bureau promoted the region through exhibits, lectures and publications.[2] Barlowe lists several factors that these land promoters were counting on:

> (1) The success achieved by those farmers who were lucky enough to settle on islands of good agricultural land;
> (2) the good local markets, both for labor and for farm products, provided by the thriving lumber industry;
> (3) the steadily rising values of farmland throughout the country; and
> (4) the promised disappearance of the virgin prairie lands to the West.[3]

Many of the railroads crossed the land most suitable for agriculture, which led Davis to observe that "the railroads may have laid out their right-of-ways through the area with an eye to both the immediate possibilities of lumber hauling and the future location of agriculture."[4] But the

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[1]An early example of a community effort is the publication of the booklet entitled The Advantages of the City of Ludington: A Brief Glance at the Opportunities Afforded for the Investment of Capital by Ludington Businessmen in 1891.

[2]Leo Alilunas, "Michigan's Cut-over 'Canaan'," Michigan History Magazine, XXVI (Spring, 1942), p. 194.

[3]Raleigh Barlowe, Administration of Tax-Reverted Lands in the Lake States, Michigan State College Agricultural Experiment Station Technical Bulletin No. 225 (East Lansing, December, 1951), p. 7.

[4]Davis, p. 101.

anticipated agricultural boom never materialized. Those farmers who did stay on after the lumbermen left and those who heeded the speculator and purchased cutover land were soon disappointed. A few areas, especially in the hardwood zones, were effectively cropped, but most of the land rebuffed the attempts to cultivate corn, barley and potatoes. Without a large local market, the poor soils and short growing season render Northern Michigan unprofitable for agriculture. The value of all farm crops was less than $10.00 per acre of land for twenty-one counties in Northern Michigan in 1919; Roscommon and Crawford Counties had a value per acre of less than $1.00.[1]

The employment in logging and milling declined rapidly following the mining of the white pine and the depletion of the best hardwood stands. It is estimated that in 1890, Northern Michigan (excluding Oceana, Newaygo, Mecosta and Midland Counties) had 700 logging camps and 25,000 loggers. By 1923, there were only ten logging camps with 500 loggers.[2] With the loss in forest products employment and then in other sectors of the economy, the rapid population growth experienced prior to 1900 became a slow decline after 1910. Between 1910 and 1920, 80% of the townships

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[1] Sparhawk and Brush, p. 75.

[2] Watson, p. 446.

lost population.[1] The movement of people out of the urban centers of Southern Michigan during the depression years and the large-scale development of recreational facilities halted the decline after 1930.

Table 4.--Population changes in Northern Michigan, 1890-1940.[a]

Year	Population	Year	Population
1890	293,732	1920	360,074
1900	366,112	1930	316,468
1910	399,923	1940	361,437

[a]Calculated from data given in U.S. Bureau of the Census, Census of Population, 1890, 1900, 1910, 1920, 1930 and 1940.

When the mills closed down and the farmers left, the trade centers lost their market and declined in size and function. Even though the remaining woods workers and farmers were moving out of the open country and into the towns, many of the communities were losing population, and a number disappeared from the map. Between 1910 and 1920, the incorporated places gained a slight 4.1% with six of the seven cities over 5,000 population registering a decline.[2]

[1]Sparhawk and Brush, p. 13.

[2]Ibid., p. 17.

The population decrease in the lumber centers of Au Sable and Oscoda at the mouth of the Au Sable River represents an extreme example of decline.

Table 5.--Population change of Au Sable and Oscoda, 1890-1910.[a]

City	1890	1900	1910
Au Sable	4,328	1,116	648
Oscoda	3,593	1,109	864
Total	7,921	2,225	1,512

[a]Powers, pp. 506-507.

In July of 1911, a large fire swept through the two cities, and no effort was made to build them again.

Au Sable and Oscoda are extreme cases, but as nearly all the towns of Northern Michigan received their initial impetus and sustaining force from the sawmills, they lost their raison d'etre when the lumber boom ended. A number of cities developed lasting woodworking industries and others, due to a fortunate location, functioned as central places for large, thinly populated areas. Those communities which were not supported by a railroad or were near a larger commercial center died out. Davis generalized the population pattern of the towns of the High Plains as "one of rapid

increase in population to a peak which corresponds to the peak of lumbering operations; followed by a less rapid decline which in some cases, has been arrested in the last decade [1925-1935] by increased activity resulting from recreational development."[1]

The railroads lost their major source of revenue when the lumbering era ended. But the main lines continued in operation as through carriers serving the remaining towns which had developed around the mills. The railroad gave birth to most of the interior communities and served as the lifeblood for these settlements in the post-lumber period. Few of the logging lines lasted, but on their rights-of-way were built many of the roads that account for the uneven circulation pattern of Northern Michigan today. With the decline in industry and population, there was not enough traffic to produce revenues to cover expenses, and throughout the region many rail lines were dismantled. Between 1880 and 1921, about 1,240 miles, nearly one-third of the total mileage, was abandoned.[2] As previously mentioned, large development schemes were established by the railroads after 1900 in order to dispose of their land grants and to encourage settlement to provide revenue for their remaining lines.

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[1]Davis, p. 173.

[2]Watson, p. 445.

A revealing index of the decline of the economy following the mining of the forest resource is the fluctuation in land values and tax returns. Idle forest land results in a reduction of property available for taxation and an increased burden of taxation on other property. As roads, bridges and schools had to be maintained, the property taxes were increased on the remaining population. The fewer the people in the community, the higher the per capita tax burden. In many areas, the basis of assessment was increased to the full value of the property even though these values were often highly inflated (see Table 6). As a consequence of the high taxes resulting from inflated land prices and over-expanded governmental services and institutions, severe financial hardships were experienced by many land owners in the region.[1] During the depression years of 1929-1933, thousands of landowners forfeited their cutover lands for taxes. In order to keep the cutover lands in private ownership, Michigan placed a tax moratorium on the land

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[1]Davis attributes much of this problem to the inadequacy of the system of political organization which was designed for agricultural land use. Organized into townships and counties under the Ordinance of 1785, the fragmented system was ill-suited to the sparsely populated and widely dispersed settlement following the depletion of the timber. Charles M. Davis, "Functional Areas in Political Readjustment," Economic Geography, XIV (January, 1938), pp. 85-88.

(1933-1938), but within a year after it was removed, 2,200,000 acres reverted to the state.[1]

Table 6.--Change in tax rate per $1000 valuation for selected counties, 1892-1921.[a]

County	1892	1921
Antrim	$22.01	$38.43
Charlevoix	25.87	51.08
Kalkaska	22.54	41.06
Lake	30.03	52.52
Missaukee	23.11	49.63

[a]Sparhawk and Brush, p. 49.

In Northern Michigan, the mining of the forest resource removed the region's basic economic support. Forest exploitation had initiated and then dominated the organization of human activities in the region, and when the forest was mined and no substitute was introduced, the economy collapsed. The result was decay, depopulation and a severe contraction of industrial and commercial function. Whitaker and Ackerman describe the character of the region in these terms, "desolate cutover areas of barren sands or scrubby

[1]Con H. Schallau, Forest Owners and Timber Management in Michigan, Lake States Forest Experiment Station Research Paper LS-9, Forest Service, U.S. Department of Agriculture (St. Paul, March, 1964), p. 21.

growth, deserted or run-down farms, and trade centers that have seen their better days."[1] The legacy of the mined resource is even more pointedly revealed by Strassmann's assertion that Northern Michigan became a land of "empty stores, vacant houses and deserted farms."[2]

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[1]Whitaker and Ackerman, p. 31.

[2]W. Paul Strassmann, Economic Growth in Northern Michigan, Institute for Community Development and Services General Bulletin No. 2, Continuing Education Service, Michigan State University (East Lansing, 1958), p. 1.

CHAPTER III

THE SECOND-GROWTH FOREST: INTRODUCTION OF FOREST MANAGEMENT AND NEW INDUSTRY

Introduction

Northern Michigan again supports a forest resource of economic significance. The renewed importance of the forest resource is due to an increased volume of timber resulting from natural growth and management of the resource and technological advances which permit the use of most species. But the character of the second-growth forest differs substantially from the original forest resource. No longer are there large pure stands of white pine and other conifers; the second-growth forest is essentially a hardwood forest dominated by aspen, oak and birch. The Forest Survey completed in 1956 showed Northern Michigan as having 3,428,000,000 board feet of hardwoods of sawtimber size and 1,141,000,000 board feet of conifers. In growing stock,[1] there were reported 32,442,000 cords of hardwoods and only

[1] Trees from stump to a minimum of four inches top diameter of the central stem inside bark.

7,547,000 cords of softwood conifers.[1] Northern Michigan accounts for 32% of the hardwood growing stock in the state, but only 4.5% of the softwood growing stock, most of this in plantations.

With the regrowth of the timber, various forest product industries were attracted to the region. Of the numerous industries which are supported by the forest, pulp and paper has grown the most rapidly. In this chapter, the management of the Northern Michigan forest resource for continuous production is discussed and an examination made of the structure of industry based on the resource. Particular attention is given to the growth of the pulp and paper industry.

Forest Management

The overall objective of managing the forest resource is to establish conditions that will assure a sustained flow of forest products at the highest and most efficient level of production.[2] Depending on local forest conditions, ownership patterns and desired forestry goals, the measures utilized

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[1]Virgil E. Findell and Ray E. Pfeifer, Net Timber Volume in Michigan by Species Group and County, Lake States Forest Experiment Station Technical Note No. 548, Forest Service, U.S. Department of Agriculture (St. Paul, January, 1959), p. 2.

[2]Virgil E. Findell et al., Michigan's Forest Resources, Lake States Forest Experiment Station Paper No. 82, Forest Service, U.S. Department of Agriculture (St. Paul, September, 1960), p. 27.

in management vary considerably. This section considers techniques of forest management with a brief inquiry into the development of forest management in Northern Michigan. Specific management practices and problems will be discussed in greater detail in Chapter VI.

Important techniques utilized in managing the forest resource include fire protection, control of disease and insects, reforestation and selective cutting. The problems of disease and insects are especially acute on smaller, privately-owned stands, where they account for a greater drain on the timber supply than cutting. Through reforestation, the forest is artificially reproduced. This practice is often a necessity for forest growth in areas which have been mined, leaving few trees for natural seeding. Selective cutting involves a number of cutting practices designed to achieve specified management goals. This may mean the removal of old or diseased trees to make room for new growth or the cutting of certain species to accelerate the reproduction of more desired species.

Management of the Northern Michigan forest resource grew out of the increasing public ownership of forest land.[1] As mentioned in Chapter II, much of the forest land reverted to public ownership through the non-payment of taxes in the 1930's. In 1960, state and national forests accounted for

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[1]Barlowe, Administration of Tax-Reverted Lands in the Lake States, p. 74.

35% of the region's forest land.[1] These public lands have been managed by professional foresters with the goal of "building up," or increasing the volume of the forest. One of the most significant accomplishments has been the planting of over 660,000 acres of conifers, chiefly red pine and jack pine.[2] Beginning in 1904 near Higgins Lake, reforestation initially centered only on public land, but in the last two decades, large tracts of private land have also been planted. Today, the total acreage in plantations is nearly evenly divided between national, state and private ownerships.[3]

Through management, Northern Michigan again supports a forest resource of economic significance. Forest volume has increased through natural growth, reforestation, fire and disease control and selective cutting. Forest Survey reports indicate that between 1935 and 1955, sawtimber[4] volumes increased by 146% and the volume for all trees by 96%.

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[1] Findell et al., p. 9.

[2] Robert N. Stone and Clarence D. Chase, Forest Plantations of Northern Lower Michigan, Lake States Forest Experiment Station Paper No. 102, Forest Service, U.S. Department of Agriculture (St. Paul, 1962), p. 7.

[3] Ibid., p. 8.

[4] Trees that contain at least one merchantable sawlog with a minimum top diameter inside bark of eight inches.

Structure of the Forest-Based Industry

With the change in the composition of the forest resource has developed a corresponding change in the forest product industries. The lumber industry which dominated the regional economy for half a century is still the most pervasive regional wood-processing activity because of the large number of small mills. In 1964, there were only 122 sawmills which produced 200 or more cords; of these, 25 were portable mills.[1] In 1963, the Michigan Conservation Department reported that Northern Michigan produced 8,038,400 board feet of lumber (about one-third of the output for 1854), of which 6,547,300 board feet was hardwood. Newaygo and Oceana Counties in the southwestern part of the region accounted for nearly one-fifth of the total production. The moderate resurgence of the lumber industry is due to the increasing volume of sawtimber in the region and the growing demands of the pallet industry[2] for low-grade sawtimber.

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[1] Forestry Section, Michigan Department of Conservation, 1964 Directory of Northern Lower Peninsula, Michigan (Lansing, 1964).

[2] A pallet is a raised platform, usually made of wood, used in handling heavy or bulky materials by a forklift truck with a minimum of hand labor. Companion to automation of industry, there has been increased use of pallets for handling during production and for shipping. In the auto industry, packaged or individual parts are placed on a pallet and moved by forklift or other conveyance from a truck or railroad car to storage or to the production line in assembly plants.

These transportation platforms are used extensively in the automotive and other manufacturing industries in Southern Michigan. The Ford Motor Company used 4,810,000 board feet of hardwoods and 450,000 board feet of pine in the form of pallets in 1956; this was equivalent to 2.7 board feet of wood for each vehicle Ford produced.[1] Possessing the forest resource and access to the major market area, Northern Michigan has participated in this growth industry on a large and increasing scale. The Michigan Conservation Department reports forty-five pallet-producing plants in the region in 1964, with a concentration of establishments in the southern two tiers of counties. The federally financed Center for Economic Expansion and Technical Assistance at Central Michigan University has encouraged the development of the pallet industry because it requires moderate capital investment to begin operations, acts as a concentration yard for low-grade timber and employs semi-skilled local men who are otherwise underemployed.[2]

Another growth industry has been the manufacture of charcoal and charcoal briquettes for outdoor cooking use.

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[1]Charles F. Sutherland, Jr., The Market for Wood Pallets in the Auto Industry: A Case Study of the Ford Motor Company, Lake States Forest Experiment Station Paper No. 104, Forest Service, U.S. Department of Agriculture (St. Paul, September, 1962), p. 1.

[2]Interviews with Dr. Howard R. Sommer, Director, and William C. Strohschein, Forest Products Specialist, Center for Economic Expansion and Technical Assistance, Central Michigan University, Mt. Pleasant, Michigan, April 26, 1966.

This industry is important as it uses crooked or poor-quality trees which, as a part of forest management, should be removed from the forest but are of no use to other industries. Of declining importance is the production of veneer logs, which was established as early as 1912, using the remaining hardwoods of Northern Michigan. With increased competition from other products and producing areas and the failure to develop innovations to allow extensive use of the second-growth forest, the veneer industry is no longer of major significance. Only three veneer plants were listed for the entire region in 1964. Other forest product industries of modest importance to the post-lumbering era economy of Northern Michigan are furniture, poles, excelsior, plywood, flooring, log cabin building and rustic novelties. A new industry to the region, the production of particle board, began in 1964 at the Novoply Plant of U.S. Plywood Corporation at Gaylord in Otsego County.

Growth of the Pulp and Paper Industry

At present, the most important manufacturing industry in Northern Michigan is the pulp and paper industry.[1] The industry first entered the region about 1890, using the then abundant spruce and fir. As it did in the Northeast, the

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[1] Pulping is the process of separating the usable cellulose fibres from the raw material. Paper-making is the matting of these fibres together into a sheet.

pulp industry followed the lumber industry and soon grew to large proportions. Early mills include the Fletcher Paper Company, which started making sulphite, express and manila paper in Alpena in 1899, and the Cheboygan Paper Company, which was organized to manufacture newsprint in 1902. It is reported that by 1912, the Cheboygan Paper Company employed nearly 200 men and was adding $150,000 annually to the community through wages, prices paid for wood and taxes.[1] In 1909, there were pulp mills in operation at Alpena, Cheboygan and Petosky. Together, these mills had a daily capacity of fifty tons of groundwood pulp and seventy-five tons of sulphite[2] fibre.[3] As the industry expanded throughout the Lake States, another Northern Michigan mill was opened at Filer City near Manistee.

However, with the mining of the timber, the state did not have the necessary resource base to sustain the industry. Because heavy plant investment makes pulp mills less mobile than lumber mills, the industry was reluctant to leave when the primary pulping species, spruce and fir, were exhausted. By 1920, the pulp and paper industry had to import 1,590,300 board feet of timber. According to a study

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[1] Powers, pp. 455-56 and 473.

[2] The characteristics of each of the pulping processes are described later.

[3] Lockwood's Directory of the Paper, Stationery, and Allied Trades, 34th edition (New York: Lockwood Trade Journal Company, Inc., 1909).

by the National Resources Committee, 65% of the forest resource in the cutover lands in the Lake States consisted of "weed" species such as aspen, oak and jack pine.[1] Although jack pine was utilized by the pulp mills during the decade of the 1930's, the industry waned because of the inadequate supply of the preferred species. A part of this decline, however, may be attributed to the duty-free import of competing pulp and paper products from Canada and Western Europe. Though not important nationally, the local industry remained significant within the regional economy. Table 7 presents the changes in capacity of the pulp and paper industry between 1900 and 1939.

Present Structure of the Pulp and Paper Industry

Since aspen and other hardwoods abundant in Northern Michigan have been adapted to various pulping processes, the industry has expanded rapidly. There are two pulp and paper corporations operating three pulp mills in Northern Michigan and three other companies operating mills in Southern Michigan which obtain pulpwood in the north. In addition, the particle board plant in Gaylord utilizes roundwood suitable for pulping (see Figure 9). Together, the five pulp and

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[1] Northern Lake States, Part VIII of Regional Planning, report of the Northern Lake States Regional Committee to the National Resources Committee (Washington: U.S. Government Printing Office, 1939), p. 3.

paper companies utilizing Northern Michigan's forest resource have a daily pulping capacity of 1,575 tons (see Table 8). Prior to the installation of an additional 280 tons capacity in early 1966, these mills accounted for 66% of the capacity in Michigan and 15% of that for the Lake States. The combined capacity of the sulphate and semi-chemical mills of the Packaging Corporation of America plant at Filer City is the largest in Michigan and in the Lake States is second only to the Minnesota and Ontario Paper Company mill at International Falls.

Table 7.--Daily capacity of Northern Michigan pulp mills by pulping process for selected years (in tons).[a]

Year	Number of mills	Groundwood	Sulphite	Sulphate	Total
1900	2	30	25	0	55
1909	4	50	85	0	135
1918	5	35	75[b]	30	140[b]
1928	3	0	80	50	130
1939	2	0	40	65	105

[a] Lockwood's Directory of the Paper and Allied Trades, 25th, 34th, 43rd, 53rd and 64th eds. (New York: Lockwood Trade Journal Company, 1900, 1909, 1918, 1928, and 1939).

[b] Does not include one mill.

Table 8.--Daily capacity by pulping process of the mills using Northern Michigan roundwood (in tons).[a]

Year	Number of Mills	Ground-wood	Sul-phite	Sul-phate	Semi-Chemi-cal	Other[b]	Total
1950	5	0	130	220	10	0	360
1956	7	70	150	140	515	0	875
1960	8	60	165	165	560	240	1,190
1965	6	0	170	290	530	300	1,290
1966	6	0	170	405	700	300	1,575

[a]Data for 1950, 1956 and 1960 are as of January 1 of each year and were obtained from Lockwood's Directory of the Paper and Allied Trades, 81st, 85th and 90th eds. Data for 1965 and 1966 are as of July 1 of each year and were obtained from interviews and correspondence with managers of the pulp and paper mills between May 21 and June 29, 1966.

[b]Capacity of the special-process hardboard plant at Alpena.

Two phenomena operating in Northern Michigan that are characteristic of the nation as a whole are revealed in the above table. First, the rapid increase in the capacity of the pulping processes using hardwoods and, secondly, the decrease in the number of mills, with a corresponding increase in the size of the remaining mills.

In Michigan, the semi-chemical and sulphate mills and special process mill are the largest users of hardwoods. Using only aspen and other hardwoods, the development of the

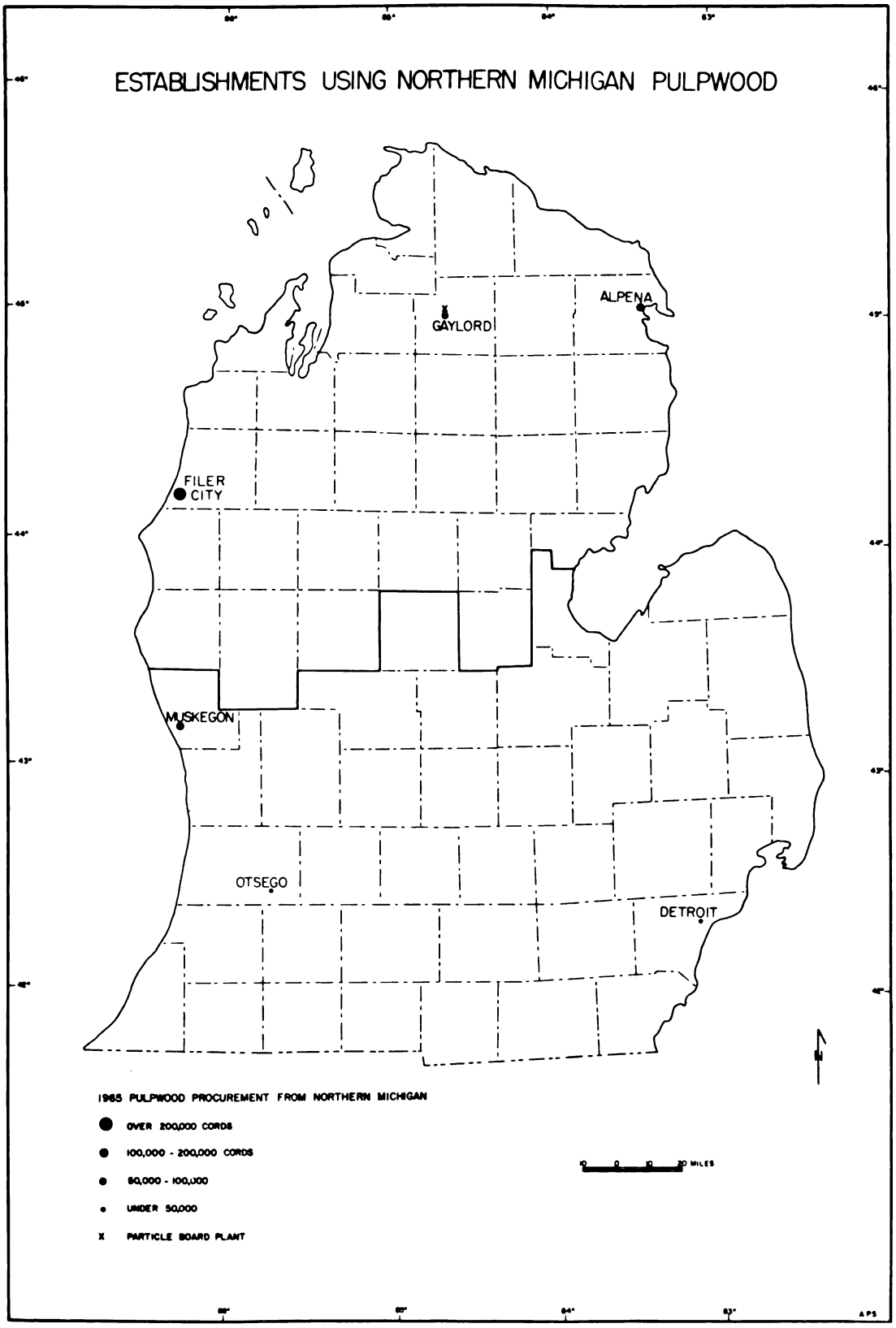
ESTABLISHMENTS USING NORTHERN MICHIGAN PULPWOOD
ALPENA
GAYLORD
FILER CITY
MUSKEGON
OTSEGO
DETROIT
1965 PULPWOOD PROCUREMENT FROM NORTHERN MICHIGAN
OVER 200,000 CORDS
100,000 - 200,000 CORDS
50,000 - 100,000
UNDER 50,000
PARTICLE BOARD PLANT
MILES

Figure 9

semi-chemical process has revolutionized the Lake States pulp and paper industry. Expanding from a daily capacity of 10 tons in 1950 to 700 tons presently, the semi-chemical process is the most important in Lower Michigan.[1] Also of increasing importance is the sulphate process, which utilizes hardwoods and local pine. A special process mill producing hardboard began operation in 1958 with aspen as its chief raw material. One medium-sized sulphite mill remains which uses imported softwood and local hardwoods.

Following a national trend, Lower Michigan mills are decreasing in number and increasing in size. In 1960, eight mills had a total daily capacity of 1,190 tons for an average of 149 tons per mill; in 1966, six mills register a capacity of 1,570 tons, or 260 tons per mill. Between 1960 and 1966, two small mills, one groundwood and one semi-chemical, terminated operations, while three of the medium-sized mills increased their combined daily capacity from 485 tons to 840 tons. One mill manager pointed out that because of the economies of scale realized in high-volume wood procurement and mill mechanization, he no longer considered it economical to operate a pulp mill below 250 tons daily capacity.[2]

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[1] The lower peninsula.

[2] Interview with Roman Suess, General Manager, Otsego Falls Mill, Menasha Corporation, Otsego, Michigan, June 9, 1966.

Paper and Board Products Manufactured

All of the pulp mills utilizing the forest resource of Northern Michigan are vertically integrated in that they operate in conjunction with a paper or board mill. Two paper mills located in Northern Michigan, Fletcher Paper Company at Alpena and Charmin Paper Products Company at Cheboygan, purchase woodpulp. As shown in Table 9, the products of the paper and board mills include a wide range of grades.

Table 9.--Paper and board products manufactured in Northern Michigan or in other mills using the region's forest resource.[a]

Corporation	Products
Abitibi (Alpena)	Hardboard, hardboard specialties and rigid insulation board products
Charmin (Cheboygan)	Sanitary tissue
Fletcher (Alpena)	Various bonds and printing paper
Menasha (Otsego)	Corrugating medium
Packaging (Filer City)	Corrugating medium and bleached Kraft paperboard
S.D. Warren (Muskegon)	Book paper, plain and coated printing papers
Scott Paper (Detroit)	Sanitary tissue, wax paper and printing papers
U.S. Plywood (Gaylord)	Particle board

[a]Information was obtained from interviews and correspondence with managers of the pulp and paper mills.

The corrugating medium manufactured by both Packaging Corporation and Menasha forms the fluted core of corrugated containers, serving as a shock absorber. Fletcher and Scott produce medium-quality printing papers and bonds, while S. D. Warren makes high-grade paper for use in custom products such as college yearbooks. Scott and Charmin both produce tissue paper stock, and Scott converts it for consumer use. Packaging Corporation also manufactures bleached Kraft paperboard for use in small cartons such as cereal boxes and pharmacy boxes.

Although somewhat similar in their uses, the particle board manufactured by U.S. Plywood and the hardboard produced by Abitibi are constructed differently. Hardboard is manufactured from wood pulp which is bonded together by natural lignen, pressed and hardened. Particle board consists of distinct particles of wood bonded together with a synthetic resin or binder and pressed into a board. Hardboard is denser and is used in the manufacture of furniture and office equipment and in building and construction. Particle board is used as a core for veneered furniture and in construction.

Current Wood Utilization

The total roundwood consumption of the five pulp mills[1] and the particle board plant was approximately 750,000

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[1]As Packaging Corporation operates two pulp mills in Filer City, there are actually six pulp mills at five sites.

cords in 1965, of which nearly 620,000 cords were produced in Northern Michigan. Excluding consumption data for one mill which relies heavily on Canadian imports of spruce and balsam fir, Northern Michigan supplied over 92% of the total roundwood consumed.

Table 10.--Roundwood utilization by species, 1965 (in standard cords).[a]

Aspen	Birch	Mixed Hardwoods	Pine	Spruce	Fir	Total
443,760	28,993	12,436	129,274	55,871	78,435	748,769

[a]Interviews and personal correspondence with managers of the pulp and paper mills.

Reflecting the rapid growth of the pulpwood-using industries during the five-year period 1961-1965, roundwood production in Northern Michigan increased from 450,000 cords to nearly 620,000 cords. Another source of pulpwood, sawmill residue in the form of chips, was first used in 1964 and provided an equivalent of 30,000 cords of wood in 1965. Roundwood production is expected to exceed 700,000 cords in 1966 and the use of mill residue to more than double. The roundwood production for 1966 may be held to 1965 levels, however, if the shortage of loggers experienced in the winter and spring continues throughout the year.

CHAPTER IV

NATIONAL GROWTH AND STRUCTURE OF THE PULP AND PAPER INDUSTRY

Introduction

The second model of forest utilization conceptualized considered the persisting influence on the organization of human activity of a forest resource managed for continuous production. In order to investigate the persisting character of the man-resource relationship established in this model, the expansion of the pulp and paper industry in Northern Michigan is observed. As the regional growth of the pulp and paper industry is a function of national conditions, the national structure of the industry is also examined. This chapter will investigate the role of technology in the growth of the pulp and paper industry, the national distribution and economic structure of the industry and the conditions for demand and future growth. For added information, tables presenting projections for the future growth of the pulp and paper industry and the assumptions underlying these projections are discussed in Appendix II. In subsequent chapters, the competitive position of Northern Michigan for the pulp and paper industry will be examined.

Role of Technology in the Pulp and Paper Industry

To permit an understanding of the changing national pattern of the pulp and paper industry, the role of technological innovation in the industry must be examined. The pulp and paper industry presents a dynamic history characterized by the frequent introduction of new methods and ideas which change the types of raw materials used and the products manufactured. Stevenson described this attribute of the industry in 1940: "New locations, new processes, new materials, are developed so frequently, that there is no indication of a static condition in sight."[1] Using rags as the raw material, the first paper mill in the United States was founded in Pennsylvania in 1690. Through the introduction of chemicals into papermaking, a number of raw material sources--straw, hemp, jute, cotton-hull fibre and wood--came into use in the nineteenth century. Although some straw and rags are still used, wood had become the standard raw material for pulp and paper by 1900.

Two notable methods of obtaining cellulose from wood were developed in the nineteenth century: the soda pulp process was introduced into the United States in 1854 and the

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[1]Louis Tillotson Stevenson, The Background and Economics of American Papermaking (New York: Harper & Brothers Publishers, 1940), p. 34.

groundwood process in 1867.[1] The utilization of wood for cellulose revolutionized the pulp and paper industry; here was an abundant and varied raw material that was compact and easily handled, yet provided a high pulp yield. Prior to the introduction of wood into the pulp and paper making process, finding enough of a suitable raw material had been the major limiting factor of the industry. As stated by Kellogg, "There never was paper enough in the world until it was made of wood."[2] When wood pulp papers appeared, the price of paper was lowered, demand for paper products was stimulated and the industry grew rapidly.

Changing technology in the pulp and paper industry has spatial expression. When a variety of accessible raw materials was utilized, the industry consisted of a large number of small, market-oriented, independently-operated mills.[3] Regional shifts have occurred in response to the location of new areas of inexpensive raw materials found to be useful through the development of new techniques in paper making. Large urban centers in the Northeast supported the largest concentration of mills when rags were the chief raw

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[1] Ibid., p. 22.

[2] Royal S. Kellogg, Pulpwood and Wood Pulp in North America (New York: McGraw-Hill Book Company, Inc., 1923), p. 15.

[3] Helen Hunter, "Innovation, Competition, and Locational Changes in the Pulp and Paper Industry: 1880-1950," Land Economics, XXXI (November, 1955), p. 315.

material. But with the advent of wood pulp, paper mills were located in the forested areas of New England and New York. Here were found large supplies of desired forest species and low-cost water power.[1] It was when the forest resources of the Northeast proved inadequate for the rapidly expanding industry that the Lake States, including Northern Michigan, began to participate in the growing industry. However, the existing pulping processes[2] were oriented toward species that were becoming increasingly short in supply in Northern Michigan. By the time of the Depression, imported wood was sustaining the industry. Relative to the national growth of the pulp and paper industry, especially in the South and the Pacific Northwest where supplies of preferred species were abundant, Northern Michigan experienced a decline. Thus, the focal point of pulp and paper production progressed from the East to the Lake States and is now

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[1]National Resources Planning Board, Industrial Location and National Resources (Washington: U.S. Government Printing Office, 1943), p. 162.

[2]The methods by which the wood fibres are separated and rearranged in order to produce pulp are referred to as the pulping processes. Three broad headings may be used to describe these processes: mechanical, chemical, and semi-chemical and chemi-mechanical. In mechanical pulping (groundwood), the wood is reduced to pulp fibre by pressing on a revolving grindstone. In the chemical processes (sulphite, soda and sulphate, often called Kraft), the wood fibres are separated by cooking in a chemical solution. The semi-chemical and chemi-groundwood processes soften the wood with chemicals and then mechanically reduce the fibres. Each of the processes produces a different quality of wood pulp, and the method chosen depends upon the type of wood used and the requirements of the end product.

concentrated in the Far West and South. In 1964, the East North Central States produced nearly 19% of the nation's paper and paperboard, with Michigan accounting for 5%.[1]

Distribution of Pulp and Paper Mills

The process of manufacturing paper and board products occurs in three distinct stages: the reduction of pulpwood and other raw material into pulp, the conversion of pulp into various grades of paper and board, and the manufacture of specific products using paper and board as a raw material. Each of these stages has a distinct spatial expression. Being ubiquitous in its secondary stage, in some form the pulp and paper industry is located in forty-six states and the District of Columbia. The primary pulp manufacturing stage is found in areas where raw material is present, while the plants converting paper and board to finished products are located wherever a large enough market exists for the commodities. For the industry as a whole, four regions of production emerge: the South, the Far West, the Northeast and the Lake States.

The most pervasive of all sectors of the pulp and paper industry are the establishments converting paper and paperboard into numerous final products. As many of these plants are small and have little connection with the paper

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[1] U.S., Bureau of the Census, Current Industrial Reports Series: Pulp, Paper, and Board: 1964 (Washington, 1965), p. 9.

industry other than as a source of raw material, they are difficult to identify. According to Lockwood's Directory, there are over 3,300 such paper conversion operations in the United States. As seen on Figure 10 the greatest concentration is in the populous states of New York, Illinois, Pennsylvania, California, Massachusetts, New Jersey and Ohio.[1] These states account for 60% of the total paper-converting plants in the nation. Michigan ranks ninth, with 113 converting plants.[2]

The most concentrated sector of the pulp and paper industry is the pulp mill engaged in the manufacture of pulp from wood or from other raw materials; these resource-oriented operations are found in only twenty states. Between the extremes of market-oriented converters and the resource-oriented pulp mills are the establishments which process pulp into paper or integrate two or more stages of the manufacturing process. Paper mills which process their own pulp are more closely tied to the forest resource and are located near the forest resource or at a point intermediate to the resource and the market. Paper mills which

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[1] Perloff et al. account for this concentration in populous areas, stating "Converted paper products industries generally add bulk and value to processed inputs for which significant weight loss has been achieved in earlier stages. This, plus the market service aspect, tends to make these sectors strongly market-oriented." Perloff et al., p. 432.

[2] Lockwood's Directory of the Paper and Allied Trades, 90th ed.(1965).

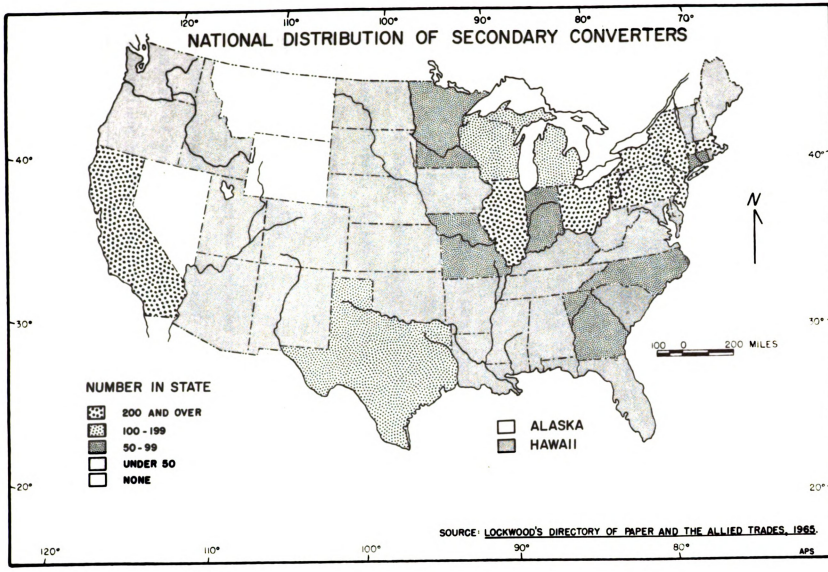
NATIONAL DISTRIBUTION OF SECONDARY CONVERTERS
120°
110°
100°
90°
80°
70°
40°
30°
20°
N
100 0 200 MILES
NUMBER IN STATE
200 AND OVER
100 - 199
50 - 99
UNDER 50
NONE
ALASKA
HAWAII
SOURCE: LOCKWOOD'S DIRECTORY OF PAPER AND THE ALLIED TRADES, 1965.
APS

Figure 10

purchase processed pulp and convert it into paper and finished paper products are not dependent on the forest resource and are found in the market areas. Mills manufacturing paperboard are operating in thirty-seven states and those making paper in thirty-one states (see Figure 12).[1]

From these maps, a general distributional pattern emerges for the industry as a whole. Four regions account for all but one of the independent pulp mills and over 90% of the mills converting pulp to paper and paperboard. At the primary pulp milling stage, the major producing area is the South, extending from Virginia to Texas and including the landlocked states of Arkansas and Tennessee. Second in importance is the Far West, including Washington, Oregon and California. Of about equal importance are the Northeast and the six Lake States, Illinois, Indiana, Ohio, Michigan, Minnesota and Wisconsin.

Economic Structure of the Pulp and Paper Industry

The pulp and paper industry is characterized by large-scale operations and a high capital investment for each dollar of production. Because of the economies of scale obtained by building larger and faster machines, the

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[1]Figure 12 maps all establishments included by the Bureau of the Census as Paper Mills, except Building Paper Mills (SIC 2621) and Paperboard Mills (SIC 2631). Pulp mills not separately classified are included in these classifications.

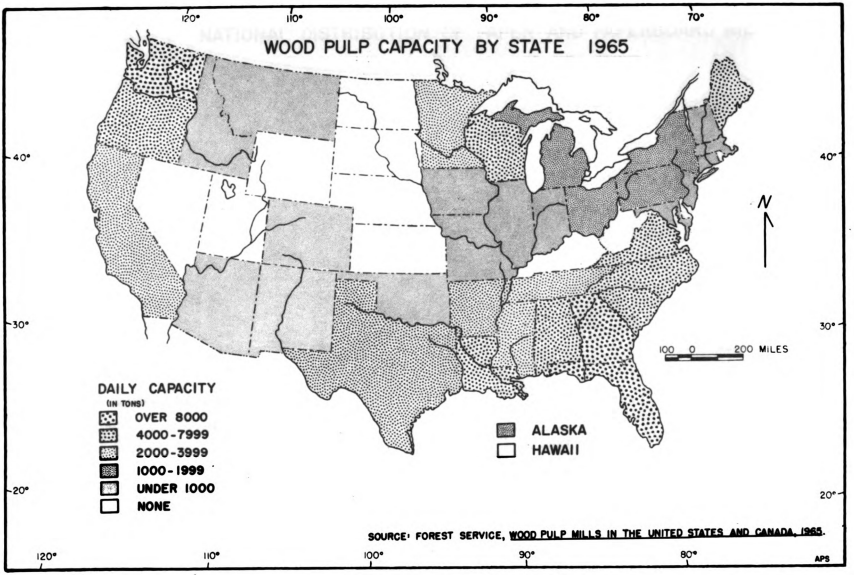
WOOD PULP CAPACITY BY STATE 1965
120°
110°
100°
90°
80°
70°
40°
30°
20°
N
100 0 200 MILES
DAILY CAPACITY
(IN TONS)
OVER 8000
4000-7999
2000-3999
1000-1999
UNDER 1000
NONE
ALASKA
HAWAII
SOURCE: FOREST SERVICE, WOOD PULP MILLS IN THE UNITED STATES AND CANADA, 1965.
APS

Figure 11

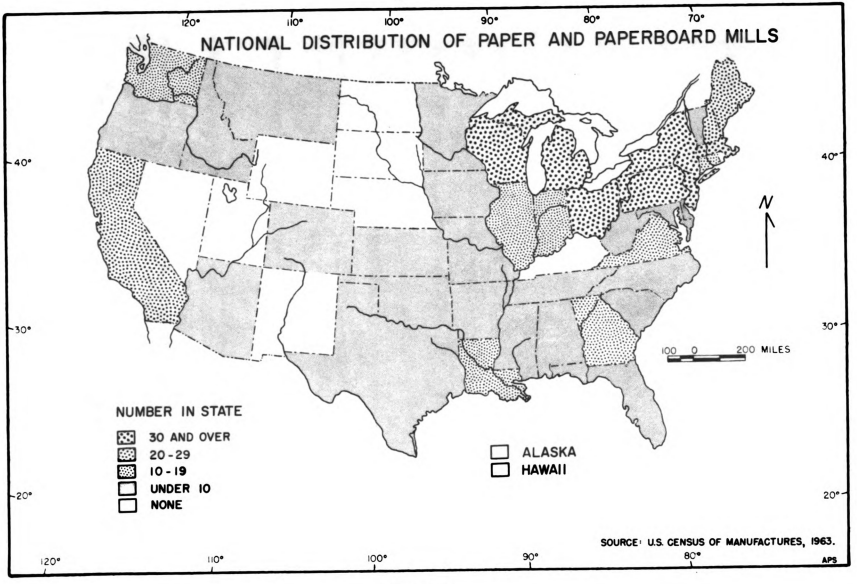
NATIONAL DISTRIBUTION OF PAPER AND PAPERBOARD MILLS
120°
110°
100°
90°
80°
70°
40°
30°
20°
N
100 0 200 MILES
NUMBER IN STATE
30 AND OVER
20 - 29
10 - 19
UNDER 10
NONE
ALASKA
HAWAII
SOURCE: U.S. CENSUS OF MANUFACTURES, 1963.
APS

Figure 12

amount of capital necessary is increasing and the size of the operations growing. Under normal conditions, the turnover of capital is low, averaging once every twenty months.[1] According to Worrell, the capital invested for each production worker was equal to 104% of the average invested for all manufacturing in 1952.[2]

Because of the increased capital needed to remain competitive, a number of mergers have taken place. During the period 1955-1964, there were 289 acquisitions, with a high of 52 taking place in 1959.[3] Historically, the pulp and paper industry has been less concentrated than other industries. In 1949, the ten largest companies accounted for only 29% of the total capacity, as compared with 100% in the automotive industry and 80% in the steel industry.[4] Even with the increasing concentration of ownership, the pulp and paper industry remains relatively less concentrated.

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[1]John A. Guthrie, The Economics of Pulp and Paper (Pullman, Washington: The State College of Washington Press, 1950), p. 111.

[2]Albert C. Worrell, Economics of American Forestry (New York: John Wiley & Sons, Inc., 1959), p. 256.

[3]U.S. Department of Commerce, Business and Defense Services Administration, U.S. Industrial Outlook, 1966: Industry by Industry (Washington: U.S. Government Printing Office, 1965), p. 34.

[4]Smith, Barney and Company, The Paper Industry Today (New York: Smith, Barney and Company, 1956), p. 11.

Data for 1961 show that the seventeen largest firms sold only 40% of the industry's total output.[1]

Manufacturing establishments in the pulp and paper industry are often vertically integrated, coordinating the control of two or more successive stages in the production process in one operating unit. Integrated mills operate a pulp mill in conjunction with a paper mill and sometimes with a subsequent conversion mill producing a finished commodity. Both backward and forward linkages are increasing as pulp and paper mills purchase forest land for raw material production and converters and wholesalers to serve the consumers (see Figure 13). Integration of the pulp producing and papermaking processes provides greater protection against price squeezes due to increased pulp costs and the expense of drying and shipping the pulp. The advantages of integrating papermaking and the manufacture of converted paper products are a guaranteed outlet for primary production and improved profit margins due to upgrading, product diversification and internal economies.[2] In Michigan, all pulp mills are integrated with paper or board mills, but only two of

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[1]Benjamin Slatin, "Paper Industry Markets and Profits," speech to the Industry Forum and Special Subjects, The New York Society of Security Analysts, Inc., New York, March 31, 1965. Xeroxed by the American Paper and Pulp Association, New York, p. 2.

[2]Smith, Barney and Company, The Paper Industry Today, pp. 76-77.

the eleven operate in conjunction with a conversion mill. At present, logging is not a part of any mill in Michigan, but several assume a part of the wholesaling responsibility.

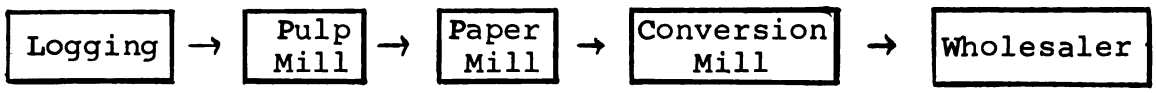

Figure 13. Vertical integration in the pulp and paper industry.

In the production of finer papers, such as writing paper and high-grade tissue, vertical integration is uncommon because of the many different grades and types utilized, the higher cost of transporting high-value paper rather than pulp and the desirability of having these paper mills located close to large markets to insure prompt delivery. The factors favoring or opposing integration express themselves in a spatial pattern of integration. Massachusetts, the center of the writing paper industry, has sixty-nine paper mills but only one pulp mill. The paper and board mills of Georgia are highly integrated, with thirteen of the nineteen paper mills operating in conjunction with a pulp mill. Reflecting the importance of the market factor, only nine of Michigan's paper or board mills operate pulp mills.[1]

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[1] Lockwood's Directory of the Paper and Allied Trades, 90th ed. (1965).

Demand and Capacity in the Pulp and Paper Industry

Because of the extensive variety of uses, paper has become the most widely employed man-made product. A persistent low cost and the continuing developments of new uses for paper products have resulted in a vigorous and consistent growth in demand (see Table 11). Exceeded only by aluminum and natural gas, the pulp and paper industry is presently the third fastest growing major industry in the United States. As the pulp and paper industry has continued to grow at a rate more rapid than that of the national economy, it is considered a growth industry. During the period 1930-1959, paper and paperboard consumption increased at a compound rate of 3.9%, while the Gross National Product was increasing at 3.3% and the national population at 1.2%.[1]

A part of this growth is attributable to the expansion in the export market for pulp and paper products. In 1954, 2.2% of production was exported, and it is expected that 4% of total production will be exported in 1966.[2] As standards of living throughout the world improve, the demand for paper products increases. The Business and Defense

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[1]Harold E. Christen, "A Survey of the Capabilities of the Lake States Forests to Support an Expanding Pulp and Paper Industry" (unpublished Ph.D. dissertation, Michigan State University, 1961), p. 22.

[2]Business and Defense Services Administration, U.S. Industrial Outlook, 1966: Industry by Industry, p. 35.

Services Administration of the U.S. Department of Commerce estimates that world demand for paper products will double by 1980.[1]

Table 11.--Apparent consumption of paper and board, 1899-1960 (in million tons).[a]

Year	Paper	Paperboard	Total
1899	1.8	.4	2.2
1909	3.2	.9	4.1
1920	5.5	2.3	7.8
1930	8.4	3.9	12.3
1940	10.6	6.2	16.8
1950	16.8	12.3	29.1
1960	22.0	17.2	39.2

[a]Data for 1899 and 1909 are taken from U.S. Department of Agriculture, Forest Service, Timber Resources for America's Future, Forest Resource Report No. 14 (Washington: Government Printing Office, 1958), p. 431. Data for 1920-1960 are taken from U.S. Department of Agriculture, Forest Service, Timber Trends in the United States, Forest Resource Report No. 17 (Washington: U.S. Government Printing Office, 1965), p. 48.

The demand for products of the pulp and paper industry is essentially derived--it is dependent upon the direct demand for the goods which use pulp and paper in their manufacture. Although some paper products such as stationery

[1]Ibid.

are directly used by the individual, most products are used as raw materials in the manufacture of other products or for the protection of goods in transit or storage. As the demand for pulp and paper products depends upon the demand for other goods or services, it is inelastic. The amount of product consumed is relatively unresponsive to price changes. If there is a limited demand for the primary good or service, a small drop in the price of the pulp or paper product used as a raw material will not greatly increase the amount demanded. However, in the long run, if substitutes for pulp and paper products could be obtained at a lower cost, the demand for the pulp and paper products would decrease.

Because of high fixed investment cost in the pulp and paper industry, it has striven to attain continuous operation at a maximum percentage of rated capacity. But there always exists a difference between the operating capacity of the industry and the consumption of paper products. Guthrie states,

> Normally, excess capacity exists in most branches of the industry, and under these circumstances supply is very elastic. However, when requirements increase to the point where excess capacity no longer exists, the supply becomes sharply inelastic, primarily because of the time required to add to the productive facilities.[1]

Except for a period during the Second World War, the increase in the wood pulp capacity has been ahead of the

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[1]Guthrie, p. 110.

increase in consumption. This has often meant a significant difference between population and capacity, which leaves a part of the capacity idle. During the Depression, mills operated as low as 58% of capacity[1] and averaged 86% between 1958 and 1964.[2] Because of the rapid rise in demand in the past five years, it is expected that mills will operate at 93% of capacity in 1966.[3]

Future Growth of the Pulp and Paper Industry

In the United States, the pulp, paper and board industry is a growth industry. Since the employment of wood as a raw material, there has been a virtually uninterrupted rise in the use of pulp and paper products. This increase has occurred not only in the absolute volume being consumed, but also in the per capita use. Although population increase may account for an absolute rise in the volume of consumption, other factors explain the per capita increase.

In his analysis of the future consumption of forest products, Streyffert discusses the role of the rise in the standard of living in the world-wide increase in per capita

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[1] Slatin, p. 6.

[2] Business and Defense Services Administration, U.S. Industrial Outlook, 1966: Industry by Industry, p. 33.

[3] Ibid.

paper and paperboard consumption.[1] He refers to a study by the FAO[2] which established a relationship between paper and paperboard consumption and per capita income, a measure of the standard of living. Pulp and paper products, according to Streyffert, "serve a number of needs associated with an increase in the standard of living . . . [and are] difficult to replace with other materials."[3] As the standard of living in the United States and the rest of the world continues to improve, the future use of products of the pulp and paper industry will largely be determined by the price at which these products can be sold relative to the price of competing materials. The three major influences on the growth of the pulp and paper industry appear to be population growth, improvement in standard of living and the relative price of paper products in comparison with other materials.

Several detailed studies projecting the future growth of the pulp and paper industry in the United States have been conducted. In these analyses, various measures of the economic condition of the nation have been used as indicators of the demand for pulp and paper products. The Forest Service

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[1]Thorsten Streyffert, World Timber, Trends and Prospects (Stockholm: Almqvist & Wiksell, 1958), p. 94.

[2]Food and Agriculture Organization of the United Nations, Rome.

[3]Streyffert, p. 101.

of the U.S. Department of Agriculture used population and gross national product,[1] while the Stanford Research Institute related paper demand to population growth and real disposable income, a component of the gross national product.[2] In other investigations, a close correlation between the Index of Industrial Production in non-durable goods and the consumption of pulp and paper products has been identified.

Although these projections are subject to invalidation by many unforeseen circumstances, the studies of the future of the pulp and paper industry in the United States all agree that the industry will adapt to changes in consumption that might occur and will remain competitive. Indications are that, in addition to satisfying domestic demand, the industry will increasingly participate in supplying the rapidly expanding foreign market. To meet the challenge of the growing domestic and foreign demand, the industry must continue to make major capital investments to increase production capacity and to improve the efficiency and flexibility of operations.

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[1] Forest Service, Timber Resources for America's Future and Timber Trends in the United States.

[2] Stanford Research Institute, America's Demand for Wood, report to the Weyerhaeuser Timber Company (Sunnyvale, California: Professional Reports, 1954), pp. 2 and 28.

CHAPTER V

COMPETITIVE POSITION OF NORTHERN MICHIGAN

Introduction

In examining the national structure of the pulp and paper industry, it was established that the industry must rapidly expand production capacity and production in order to satisfy the expected demand for its products. As a result of economic conditions, the growth of the industry will not be uniformly distributed throughout the country. The persisting influence of the forest resource on the economic structure of Northern Michigan is a function of the region's competitive position in the industry.[1] In order to ascertain the potential contribution of the forest-based pulp and paper industry to the Northern Michigan economy, the factors which influence the region's participation in the national expansion will be examined.

Throughout its history, the pulp and paper industry has expanded its production most rapidly in those regions

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[1]Competitive position refers to the ability of a region to sell a product in a market area at a price equal to or lower than that at which another region can sell this product in the same area.

with the best sources of raw material consistent with the technology of the day, as shown in Chapter IV. But the industry does not move to the least costly raw material supply unless other needed inputs are also available. Areas in Canada where pulpwood costs are measured in cents per cord rather than in dollars remain unexploited because they are far from transportation and other input factors. Several of the cost items in the pulp and paper industry do not vary spatially and are usually unimportant in locational decisions. Variations in the cost of overhead, repairs and executive salaries are based on the corporate capital structure, age of plant and equipment and position in the industry. Federal taxes may also be an important cost input but do not vary areally.

In geographic investigations, observation of coincident phenomena provides a basis for generalizations regarding the location of economic activity.[1] In studies of the pulp and paper industry, investigators have selected several variables which are associated in space with the industry and of importance in explaining the national pattern of the industry. According to Stevenson, the dominant locational requirements of the pulp and paper industry are the availability of water, power, raw materials and labor, and

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[1]H. H. McCarty, "An Approach to a Theory of Economic Geography," Abstracts, Annals of the Association of American Geographers, XLIII (June, 1953), p. 184.

proximity to market.[1] Included in raw materials are both wood and chemicals. Also to be considered in the study of the location of any industry is the price for overcoming distance, the transportation cost.[2]

Varying in degree of importance, these considerations are significant in location decisions relating to all pulp and paper mills, regardless of the type of raw material used, the process employed to produce pulp, or the product manufactured. In his analysis of the locational controls of pulp mills, Hagenstein writes that although each mill is somewhat unique in its needs, all mills require "wood, water, labor, fuel and a number of other common inputs."[3]

A useful tool in evaluating the location pattern of an industry is the substitution framework. Using this method, costs of inputs are compared to one another to determine which costs are most important in location decisions. For each of the inputs associated with the pulp and paper industry, a rate of cost substitution was developed by Hagenstein.[4] The rate was expressed as the percentage of

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[1]Louis Tillotson Stevenson, p. 8.

[2]Edgar M. Hoover, The Location of Economic Activity (New York: McGraw-Hill Book Company, Inc., 1948), p. 8.

[3]Perry R. Hagenstein, "Factors in Locating Pulp Mills," paper presented at the annual meeting of the American Pulpwood Association, May 10, 1965, in 1965 Pulpwood Annual, prepared by the American Pulpwood Association (New York: Pulp and Paper, 1965), p. 49.

[4]Ibid.

change in the cost of an input that is equivalent to a 10% but opposite change in the cost of a pulpwood input. Because of measurement difficulties, the relative importance of water supply and waste disposal were not examined. Using a hypothetical 200-ton-per-day semi-chemical pulp mill located in the Northern Appalachians as a basis for estimating quantities required, Hagenstein established his rates of cost substitution.

Table 12.--Rates of cost substitution among inputs in the wood pulp industry.[a]

Input	Per Cent Change[b]
Wood	10
Transportation	20
Labor	36
Electricity	44
State and local taxes	64
Forest land	647
Local financial assistance	1050
Industrial site	2400

[a]Hagenstein, 1965 Pulpwood Annual, p. 51.

[b]Per cent change in the cost of inputs equivalent to a 10% change in the cost of the wood input.

In this chapter, each of the factors which have a significant influence on the spatial variation of the pulp and paper industry will be discussed and an evaluation made of Northern Michigan's competitive position with respect to these considerations.

Wood

The pulp industry is closely associated in space with standing timber. As the industry directly processes pulpwood, a substantial weight loss in the raw material results. On the average, for every two tons of pulpwood consumed, less than a ton of pulp is produced. Under present technology, the availability of suitable wood at a competitive price is considered by investigators as the most important locational control of the pulp and paper industry. The continuing search for pulpwood has been responsible for the regional shifts that have occurred in the industry since the introduction of wood as a raw material.

Using data from the 1963 Census of Manufactures, it was calculated that 49% of the total cost of all materials and supplies used in pulp mills was for pulpwood. For pulp, paper and board mills taken together, pulpwood accounts for 25% of the total cost of materials and supplies.[1] Therefore,

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[1]The proportion of total cost accounted for by an input is not a sufficient index of the fundamental importance of the factor in locational decisions as its availability may be of greater importance.

even a small difference in the unit cost of wood can have an influence on the profitability of producing pulp and paper products in different regions. Of the factors considered by Hagenstein, no input could be substituted for wood at a rate less than 20% (transportation), with such important considerations as labor and power substituting at rates of 36% and 44% respectively. These comparisons indicate that wood and wood costs are of significantly greater importance than any other input measured.

As with all inputs to be considered, the consumption of wood varies between pulping processes. The manufacture of some chemical pulps requires double the wood needed in making a ton of pulp as is used in a ton of groundwood pulp. But with all processes, pulpwood remains the governing locational factor,[1] which restricts the choice of location to those accessible to adequate supplies of wood at a competitive price.

Chemicals

The pulp and paper industry is a major user of chemicals. According to the American Pulp and Paper Association, the entire industry, including establishments converting finished paper and board into various consumer goods, uses

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[1]Melvin L. Greenhut, Plant Location in Theory and Practice: The Economics of Space (Chapel Hill: The University of North Carolina Press, 1956), p. 103.

at least one billion dollars worth of chemicals each year.[1] In the manufacture of pulp and paper, chemicals are the second most important raw material (see Table 13). Chemicals accounted for 16% of the cost of materials and supplies in pulp mills in 1963 and 9% of the cost for pulp, paper and board mills taken together.[2]

Table 13.--Value of materials consumed in pulp, paper and board mills in the United States, 1963.[a]

Material	Value (in dollars)
Pulpwood	774,373,000
Chemicals	279,718,000
Wood pulp	629,340,000
Waste paper	283,646,000
Other materials	184,901,000
All other materials and components	935,587,000
Purchased fuels	265,554,000
Electricity	114,788,000

[a]U.S. Bureau of the Census, Census of Manufactures: 1963. Industry Statistics: Pulp, Paper, and Board Mills.

[1]American Paper and Pulp Association, Monthly Statistical Summary, XLII (October, 1964), p. 41.

[2]U.S., Bureau of the Census, Census of Manufactures: 1963. Industry Statistics: Pulp, Paper, and Board Mills (Washington: U.S. Government Printing Office, 1966).

The pattern and magnitude of the use of chemicals have changed significantly in the past decade. With the development of new methods of pulping and manufacturing paper and board which make extensive use of chemicals, their reported value in pulp and paper mills increased from approximately 85 million dollars in 1954 to nearly 280 million dollars in 1963.[1] The actual cost of chemicals varies widely by pulping process and may approach wood costs in some cases. For example, in a cost summary for semi-bleached cold soda pulp, chemicals may account for nearly 30% of the total production cost.

Water

In volume use of water, the pulp and paper industry ranks third behind the iron and steel and chemical industries. As water is used in the process of pulp and papermaking, an adequate supply of water of sufficient quantity and quality is a necessity.[2] Water suspends the cellulose fibre (chiefly wood pulp) from its initial manufacture through to the paper machine rollers. In addition, water is used to wash the logs, generate steam, wash out impurities from the pulp and make chemical solutions. For every ton of

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[1] Ibid.

[2] National Resources Planning Board, Industrial Location and National Resources, p. 183.

pulp, 60,000 to 80,000 gallons of water are required.[1] In its operation at Filer City, the Packaging Corporation of America uses over 36,000,000 gallons of water daily.[2]

A major problem confronting the pulp and paper industry with respect to water utilization is pollution. In some of the pulping processes, much spent liquor remains in the process water, creating problems of suspended solids and color removal and bio-chemical oxygen demand (BOD).[3] For mills using the sulphite process, water treatment may be a significant cost item, as recovery and treatment of liquors are expensive and difficult.[4] In the sulphate process, recovery is nearly complete, and parts of the chemicals are reusable.

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[1]Richard M. Highsmith, Jr., and J. Granville Jensen, Geography of Commodity Production (Chicago: J. B. Lippincott Company, 1958), p. 222.

[2]Interview with George G. Dlesk, Vice-President and Mill Manager, Filer City Mill, Packaging Corporation of America, May 21, 1966.

[3]James E. Blyth, Water Resources for Expanding Wood-Using Industries in Northeastern Minnesota, Lake States Forest Experiment Station, Forest Service, U.S. Department of Agriculture (St. Paul, 1964), pp. 3-4.

[4]E. R. Schafer, Pollution of Streams from Pulp and Paper Mills, Forest Products Laboratory Report No. 1207, Forest Service, U.S. Department of Agriculture (rev.; Madison, 1956), p. 5.

Power

The cost of power amounts to approximately 10% of the direct cost of pulp and paper manufacture. Of the eight inputs considered by Hagenstein, power was ranked as fourth in importance. Electricity is usually generated by steam, with hydroelectric power used extensively in the Far West. In 1963, the pulp and paper industry was the third largest user of electric energy, consuming 14,044 million kilowatt hours of electricity.[1] With 14,425,000 tons being purchased for $117,665,000, coal accounted for nearly one-third of the total fuel cost. The total cost to the industry for purchased fuels was $265,554,000.[2]

Power is consumed in the operation of conveyers, chippers, grinders, cooking vats for the pulp, heaters, driers and paper-machines. Even in regions using hydroelectric power, fuel is needed to provide steam for drying the paper. Fuel requirements average from one to one and a half tons of coal for every ton of paper. In addition to using expended liquor from its Kraft mill, the Packaging Corporation mill at Filer City requires 400 tons of coal and 16,000 gallons of fuel oil daily.[3]

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[1]Bureau of the Census, Census of Manufactures: 1963. Industry Statistics: Pulp, Paper, and Board Mills.

[2]Ibid.

[3]Interview with George G. Dlesk, Packaging Corporation of America, May 21, 1966.

Transportation

Transportation facilities connect the disparate inputs of the pulp and paper industry with each other and with markets. The total freight bill of the industry is the combined expenditure for assembly of raw materials and distribution of finished products. Of the inputs measured by Hagenstein, transportation cost ranked second only to wood. As the cost of conveying pulpwood and other materials is included in the price of these materials, transportation costs here refer only to the costs involved in shipping products to the market. Marketing of pulp and paper requires an extensive transportation movement from a limited number of mills to widespread and numerous consuming points.[1]

Although exact data are not recorded, generally rails carry the largest volume of pulp and paper products. In 1960, the United States paper industry produced 6.4 million tons of printing and fine paper, of which 4.1 million tons were shipped by Class I railroads. Total paperboard production was 16.7 million tons, with rail shipments totaling 8.6 million tons.[2] As much of the output was converted

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[1]Edward Margolin and William P. McLendon, Transportation Factors in the Marketing of Newsprint, U.S. Department of Commerce Transportation Series No. 2 (Washington: U.S. Government Printing Office, 1952), p. 2.

[2]Benjamin Slatin, "Regional Competitive Position of the Pulp, Paper, and Board Industry in the United States," Proceedings of the Society of American Foresters, Atlanta, Georgia, 1962, p. 94.

at the site of production and never shipped, the magnitude of the production conveyed by railroad is not accurately reflected. In Northern Michigan, mills ship between 47% and 80% of their production by railroad, with the remainder conveyed by truck.

Following the value theory of rate making, freight rates generally progress with the value of the commodity being shipped. However, Guthrie points out that shipping charges on a ton of pulp constitute a larger fraction of the total value of the product than of a ton of paper. He found that the cost of transporting a ton of pulp varied between 15% and 20% of the destination price, while the transportation costs for paper varied between 4% for high-grade writing paper and 12% for newsprint.[1]

Labor

As labor costs in the capital-intensive pulp and paper industry are less than half that of raw materials, the industry is not particularly responsive to differences in labor costs. The per cent of value added by manufacture accounted for by wages is less in the pulp and paper industry than for industry as a whole. Nevertheless, wages are an important segment in the cost structure of the industry. In Hagenstein's study, labor had a cost substitution rate of 36%, placing it third in importance among the inputs

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[1]Guthrie, p. 93.

considered. The pulp, paper and board mills of the United States employed 220,243 people in 1963 and paid out wages exceeding three billion dollars.[1] In addition, approximately 50,000 men are employed full-time, and another 250,000 part-time, to produce the nation's pulpwood harvest.[2]

Within any sector of the industry, wage rates vary little areally, except for generally higher labor costs in the Far West. Regional differences in labor costs exist because of variations in plant efficiency and types of product manufactured. Using 100 as the index of average labor cost per ton of product for the paper and board industry, rag content paper has the high value of 410 while container board has the low index of only 36.[3] Wage rates are more a reflection of the existing situation than an influence on the future pattern of the industry.

Markets

The locational pattern of any industry to some extent reflects the influence of the flow of commodities through its marketing system. Markets consist both of the ultimate

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[1]Bureau of the Census, Census of Manufactures: 1963. Industry Statistics: Pulp, Paper, and Board Mills.

[2]American Forest Products Industries, Inc., Pulpwood Industry Facts, written in cooperation with the American Pulpwood Association (1962), p. 2.

[3]Slatin, Proceedings of the Society of American Foresters, 1962, p. 93.

consumers and the intermediary establishments which handle the products for further production and distribution.[1]

In the pulp and paper industry, the role of access to markets in plant location varies with the stage of production and the product manufactured. As wood pulp loses little weight in paper making and can be shipped easily by ship or rail, pulp mills are often located in forest areas hundreds of miles distant from a paper mill. At the other extreme, plants converting paper and board to finished products are closely associated with their markets. Stafford has shown that the magnitude of the paperboard container industry varies directly with the magnitude of its market.[2] Much of the intermediate market for paper and paperboard lies in the manufacturing centers of the nation, and these mills are located at points where the greatest profit can be obtained considering both market and resources.

There exist spatial variations in the markets for various paper and paperboard products. As communities throughout the nation support daily or weekly newspapers, the market for newsprint is extensive. But the market for book paper is limited essentially to the Northeast and Lake States. Mills manufacturing standardized products are

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[1]National Resources Planning Board, Industrial Location and National Resources, p. 203.

[2]Howard A. Stafford, Jr., "Factors in the Location of the Paperboard Container Industry," Economic Geography, XXXVI (July, 1960), pp. 260-66.

usually less dependent on markets than are plants producing "special order" merchandise.[1]

Competitive Position

According to Perloff et al., "A realistic appraisal of a region's relative advantages and disadvantages with regard to input-output access is an essential starting point for an understanding of its growth potential."[2] In order to establish the growth potential of the pulp and paper industry in Northern Michigan, the region's status with respect to each of the industry's significant inputs is examined. As previously developed, these factors are wood, chemicals, transport, labor, power, water and market. All but wood are discussed in this section. The capability of the forest resource to support an expanding pulp and paper industry will be discussed in Chapter VI.

Chemicals.--As the chemical companies commonly equalize delivered prices by absorbing freight rates, regional cost variations are slight. Some chemicals are available at lower costs to southern mills, but differences are minimal. Michigan is an important producer of chemicals, and the pulp and paper industry has adequate access to those not locally available. In general, Northern Michigan compares favorably

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[1]Louis Tillotson Stevenson, p. 45.

[2]Perloff et al., p. 105.

to other regions with respect to cost and availability of chemicals.

Transport.--Northern Michigan is served by all major means of surface and air communications. Between the mileages of five rail lines,[1] all important commercial centers and twenty-eight of the region's thirty-one counties are served by railroad (see Figure 14). But there is limited duplication of service or competition between rail companies. Also, the circuitous routes followed by several of the lines add time and costs onto rail shipments. Of the six establishments using Northern Michigan pulpwood, four use rails to bring in wood, and all ship a part of their production by rail.

A network of state and federal highways serves Northern Michigan. In addition to a long-established hard-surfaced road system, six of the central counties are traversed by a limited-access freeway which extends to Detroit and other important markets. But the local roads which afford access to the forest resource are inadequate in many parts of the region. Inaccessibility of the forest is a serious problem confronting the pulpwood producers. One of the mill managers interviewed also indicated that the east-west roads in the primary system were inadequate for

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[1]The Ann Arbor, Detroit and Mackinac, Chesapeake and Ohio, New York Central and Pennsylvania Railroads.

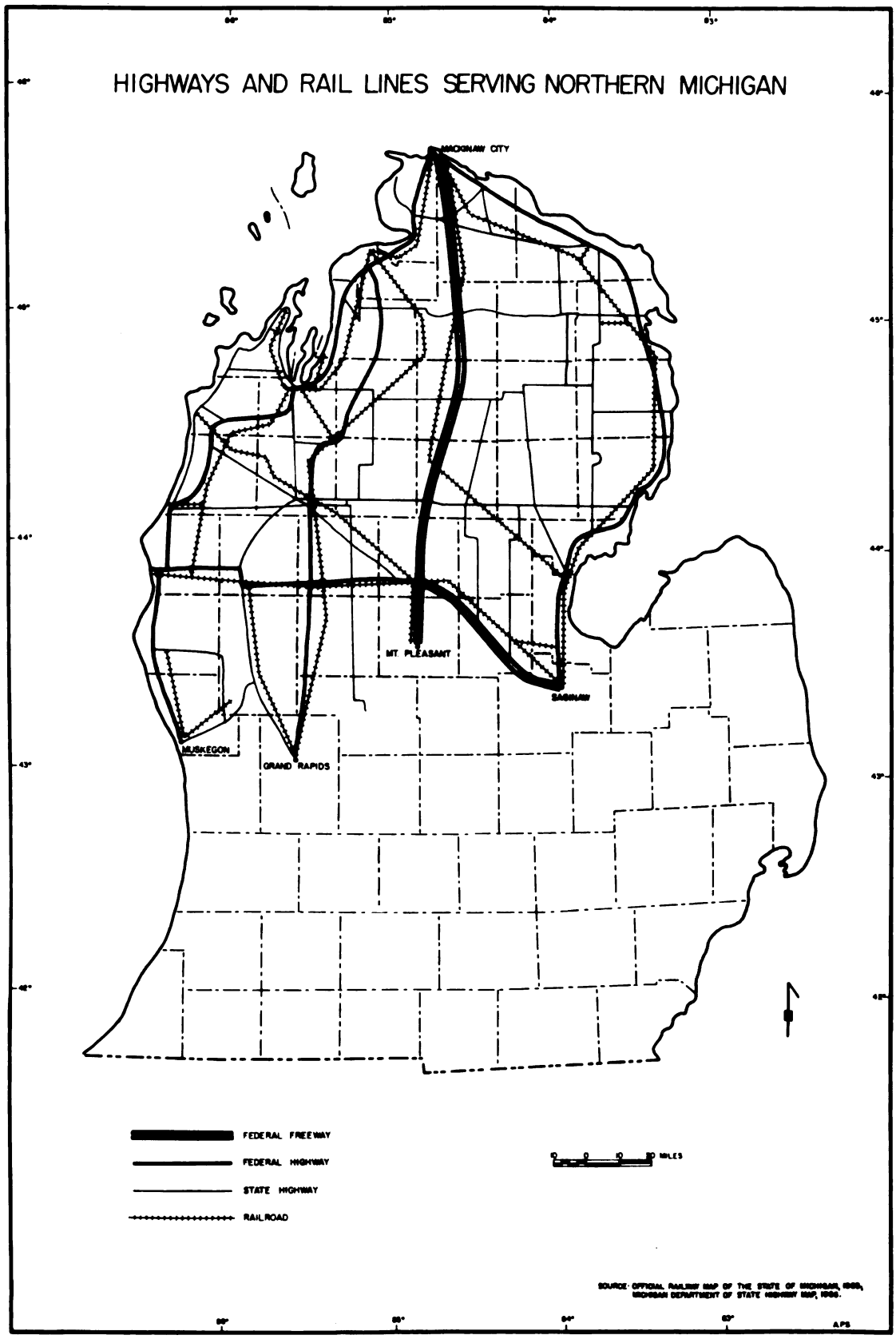
HIGHWAYS AND RAIL LINES SERVING NORTHERN MICHIGAN
MACKINAW CITY
MT. PLEASANT
SAGINAW
MUSKEGON
GRAND RAPIDS
FEDERAL FREEWAY
FEDERAL HIGHWAY
STATE HIGHWAY
RAILROAD
0 0 10 20 MILES
APS

Figure 14

transporting pulpwood from the inland counties to his coastal mill.[1]

Each county in the region is served by at least one interstate and intrastate common carrier. All the mills using Northern Michigan pulpwood obtain some pulpwood and ship a portion of their production by truck. Although trucks generally are used for shorter pulpwood hauls and rails for greater distances, two of the mills bring in all their wood by truck. In addition to land transport, fifteen counties possess deep-water access to national and world resources and markets through the Great Lakes. At present, one pulp mill obtains part of its wood supply through the St. Lawrence waterway system. Commercial air service is available at Alpena, Cadillac, Manistee, Pellston, Petoskey, Reed City and Traverse City.

Although there are limitations, the overall transportation net for Northern Michigan is good. Hagenstein indicated that the East North Central region, which includes Northern Michigan, has competitive transportation rates to markets within the region and in the Middle Atlantic and West North Central regions.[2]

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[1]Interview with George G. Dlesk, Packaging Corporation of America, May 21, 1966.

[2]Hagenstein, 1965 Pulpwood Annual, p. 51.

Labor.--Northern Michigan presently experiences a problem with respect to labor procurement. The situation is unique in that in the past there has been available a labor pool with a relatively low level of technological skill which provided woodsworkers.[1] But because of the increasing demand for labor in the large urban centers of the Lake States, there has developed a shortage of men to harvest the pulpwood.

In Michigan, as in the other Lake States, pulpwood production is in the domain of the off-season farmer and others seeking part-time work. The producer is an independent operator who contracts with a pulpwood dealer or some other middleman to provide a stipulated amount of wood for a given price. The wood is delivered to a predetermined point, often a railhead or concentration yard.[2] Unless long hours are devoted to the work, the remuneration is below that of alternative employment in the large urban centers outside the region. Many of the woodsworkers have left the region for more lucrative work, and several of the region's

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[1]In a 1955 publication of the Michigan Economic Development Department, the high unemployment rate in Northern Michigan was cited as an advantage to pulp and paper companies considering the region. "What You Should Know About Michigan as a Location for Pulp and Paper Mills," prepared by the Michigan Economic Development Department (Lansing, 1955), p. 3.

[2]Robert S. Manthy and Lee M. James, Marketing Pulpwood in Selected Areas of the North Central Region, North Central Regional Research Publication 156, Michigan Agricultural Experiment Station Research Bulletin 6 (East Lansing, 1964), pp. 34-35.

pulp mills are experiencing serious wood procurement problems because of the shortage of pulpwood harvesters.

If the pulp companies are able to make the occupation more attractive through increased payment for wood and by offering credit to producers for purchasing needed equipment, the problem could be alleviated. But these measures, together with needed mechanization of the logging operation, require capital. Mill managers do not want to allocate additional funds to pulpwood procurement for fear that the higher price of wood would make their operations noncompetitive nationally.

Power.--Purchased electricity costs are higher than in the Far West (because of better access to hydroelectric power in the latter region) and the South but similar to those in the Northeast. Costs vary less between regions for fuels purchased for the generation of electricity. Overall fuel costs are less in the Lake States than in the Far West or Northeast. As fuel oil is not widely used by the pulp and paper industry, those areas nearest the Appalachian coal fields experience the greatest advantage for fuel costs. Hagenstein found that the East North Central states have a comparative advantage over the Northeastern and Far Western producing regions with respect to fuel and power costs.[1]

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[1]Hagenstein, 1965 Pulpwood Annual, p. 51.

Water.--One of Northern Michigan's greatest advantages for the pulp and paper industry is the abundant supply of high-quality water. In addition to a lengthy shoreline on Lakes Michigan and Huron, the region contains 503 square miles of water in numerous inland lakes. Most of this water resource is of high quality and requires little or no treatment for use. With an annual precipitation exceeding thirty inches, Northern Michigan is endowed with a sustained supply of water for use by the pulp and paper industry.

A major obstacle to the use of the water resource by the pulp and paper industry is the pollution control program of the state. Increased public pressure to clean the state's waterways has resulted in high treatment costs of effluent. In one instance, the cost has affected the ability of a mill to remain competitive. Several of the mills are presently increasing their capability to treat spent liquor in order to meet more stringent enforcement of treatment requirements.

Market.--Proximity to the large and expanding market area of the Midwest is Northern Michigan's most important advantage for the pulp and paper industry. In 1960, over 40 million people, nearly one-fourth of the national population, resided within overnight shipping distance of Clare.[1] And

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[1]City in Clare County, near the defined boundary with Southern Michigan.

between 1950 and 1960, the population growth of this region exceeded the national average. The industrialized and populous market area is a major consumer of printing paper, tissue paper, boxboard and various grades of container paper. Pulp and paper mills in Northern Michigan are able to absorb higher production costs and still compete with southern mills in the Midwest because of the shorter distance.

Northern Michigan's competitive position with respect to the rapidly growing pulp and paper industry varies with the locational requirement considered. The relative cost and availability of water and transportation are favorable, while the situation with respect to fuel and labor is less favorable. Proximity to a major market area is the region's strongest advantage. Mills accept higher overall production costs in order to seek profits of large production and low mill-to-market transfer costs. In general, the economic position of Northern Michigan is favorable for a continued expansion of the pulp and paper industry. Based on the capabilities of the forest resource, the magnitude and direction of expansion will be discussed in the following chapter.

CHAPTER VI

CAPABILITY OF THE NORTHERN MICHIGAN FOREST RESOURCE TO SUPPORT AN EXPANDING PULP AND PAPER INDUSTRY

Introduction

The most significant consideration in evaluating the persisting contribution of the forest resource to the spatial structure of Northern Michigan is the capability of the forest resource to sustain an expanding pulp and paper industry. The influence of the forest resource is a function of its volume and the demand for its products. In this chapter, the existing and expected character of the forest is investigated in order to ascertain the availability of wood for present and projected demand. Problems confronting foresters in their programs to increase production are discussed, and the competitive position of the region with respect to wood supply is examined. Also, considering the available species and pulping processes and markets, the products which could be produced in Northern Michigan are studied.

The Existing Forest Resource

In Chapters II and III, the demise of the white pine and its replacement by a predominantly hardwood forest were

discussed. The character of this change has been documented by Forest Surveys conducted in the mid-1930's and the mid-1950's. Current data regarding the forest resource are unavailable, but through an examination of the 1955 Forest Survey and data concerning the annual harvest and growth, an idea of the character of the existing forest can be developed.

Table 14 presents the volume of timber by type of wood for each county and indicates the percentage of land area classified as forest land. It is apparent that hardwoods dominate both growing stock and sawtimber. As hardwoods are of greater dominance in the growing stock, it is likely they will become even more important in the future. A more complete summary of the volume, area and growth of the forest resource is provided in Table 15. From this table, it is evident that both hardwoods and softwoods are growing rapidly and that total volume is increasing appreciably. Considering existing volume and annual growth, the major species available for pulping are jack pine, aspen, Northern hardwoods and other hardwoods. As 64% of the commercial land in Northern Michigan in 1955 was either medium- to well-stocked seedlings and saplings or poletimber, the current growth probably exceeds that shown on the table. Both of these size classes have experienced rapid growth in the past decade.

Table 14.--Selected characteristics of the Northern Michigan forest resource by county, 1956.[a]

County	Growing Stock (in thousand cords)		Sawtimber (in million board-feet)		Per cent of land area forested
	Hardwoods	Softwoods	Hardwoods	Softwoods	
Alcona	1,250	433	65	65	87.8
Alpena	1,098	409	80	53	71.5
Antrim	1,118	145	140	21	66.7
Arenac	366	52	34	6	41.7
Benzie	740	91	110	15	71.2
Charlevoix	1,027	163	105	25	69.9
Cheboygan	1,476	426	140	68	81.6
Clare	1,072	137	115	19	65.9
Crawford	713	538	51	65	92.8
Emmet	1,131	167	125	25	74.9
Gladwin	718	102	66	14	57.2
Grand Traverse	756	187	103	33	59.3
Iosco	814	385	61	51	71.1
Kalkaska	784	218	96	40	82.9
Lake	1,637	259	203	39	86.9
Leelanau	1,099	112	161	26	58.4
Manistee	1,443	155	216	20	70.7
Mason	1,019	142	129	20	57.9
Mecosta	866	75	112	18	45.9
Midland	876	118	86	14	57.6
Missaukee	894	134	88	19	65.5
Montmorency	1,165	441	80	62	86.7
Newaygo	733	223	254	53	65.8
Oceana	1,144	114	96	27	51.4
Ogemaw	1,213	351	78	45	74.6
Osceola	1,171	87	132	16	52.7
Oscoda	976	697	63	108	92.6
Otsego	1,113	230	109	35	83.9
Presque Isle	1,016	462	66	59	77.2
Roscommon	1,021	331	66	54	91.4
Wexford	993	146	104	18	71.2
Total	32,442	7,547	3,428	1,139	71.5

[a]Growing stock and sawtimber data from Findell and Pfeifer, Net Timber Volume in Michigan by Species, Group and County. Per cent of area forested data from V. E. Findell and R. E. Pfeifer, Forest Area in Michigan Counties, Lake States Forest Experiment Station Technical Note No. 545, Forest Service, U.S. Department of Agriculture (St. Paul, October, 1958).

Table 15.--Commercial forest area, volume and annual growth of principle pulping species in Northern Michigan, 1955.[a]

	Red and Jack Pine	Balsam Fir and Spruce	Other Soft-woods[b]	Northern Hard-woods[c]	Aspen	Other Hard-woods[d]
Forest Area (1000 acres)	913	160	376	1,099	2,218	1,294
Volume (1000 cords)	--	1,120	--	--	10,700	--
Annual Net Growth (1000 cords)	315	83	170	296	535	518

[a]Findell et al., pp. 38, 41 and 42.

[b]Cedar, white pine and tamarack.

[c]Sugar maple, yellow birch, beech and basswood.

[d]Oak, hickory, ash, elm and cottonwood.

The character of the Northern Michigan forest resource is in a state of constant change. In an analysis of the Lake States forest resource, Dickerman discussed several factors which continually act to improve or lessen the quality of the forest: (1) the "thickening up" of the forest in recent years, (2) the presence of a sizable area of deforested land, (3) the expanding reforestation program, (4) the stabilized ownership pattern, (5) the favorable outlook

for aspen, (6) the concern about maintaining conifers and (7) the expanding supply of oak.[1]

In the long run, factors two and three, regarding deforested land and an active reforestation program, will largely eliminate each other. Along with improved management practices, the plantation program will alleviate the concern for maintaining conifers expressed in point six. The ownership pattern will be discussed later in this chapter, but attention will now be given to the factors dealing with the "thickening up" of the forest and the expanding supply of oak and aspen.

Both oak and aspen, along with other hardwoods, have been underutilized in Northern Michigan. Only in the past twenty years have these woods been used extensively by the pulp and paper industry. As these species dominate, and will continue to dominate, the forest resource, any additional expansion of the pulp and paper industry is predicated on developing new techniques to more fully utilize them. As recently as 1946, aspen was called a "weed," but it is now the primary pulping species. Pulping processes which use oak and the other hardwoods must be developed as they were for aspen.

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[1]M. B. Dickerman, The Changing Forests of the Lake and Central States Region, Lake States Forest Experiment Station Miscellaneous Report No. 31, Forest Service, U.S. Department of Agriculture (St. Paul, October, 1954), p. 10.

In order for a forest resource to be productive, a part of the annual growth should be harvested annually to reduce loss through over-age, death and disease. Depending on whether the desired growing stock is too large or too small, more or less than the annual growth may be harvested. In determining the "allowable cut," the amount of wood that is to be cut, the size of the growing stock needed to meet specified goals is considered. Where growing stocks have been severely reduced by past logging activity, as in Northern Michigan, the allowable cut is kept below annual growth to permit growing stock to accumulate. In establishing an allowable cut for various species in a region, forest type, species composition, stand-size class and feasibility of logging operations are all considered.

In 1954, for Michigan as a whole, the allowable cut was set at about 33% of annual growth for jack pine, 45% for balsam fir, 67% for aspen and 63% for northern hardwoods.[1] Consistent with more recent data showing increasing annual growth, allowable cuts have been revised upward by the Forest Service for National Forest lands (see Table 16) and the Michigan Department of Conservation for State Forest lands. Suggested cuts for private lands issued by the Forest Service Research Station at St. Paul have also been increased.

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[1]Findell et al., p. 45.

Table 16.--Allowable cut by species, Huron National Forest, 1952 and 1965 (in standard cords).[a]

Species	1952	1965
Jack pine	32,600	21,450
Aspen	10,300	33,930
Oak	5,800	21,680
Red pine	500	3,090

[a]Personal communication from John Von Bargen, Forest Supervisor, Huron-Manistee National Forests, June 29, 1966.

Although the allowable cut is a desired forest management goal, it is seldom attained in Northern Michigan. Table 17 shows that in 1955 the allowable cut was not reached for any of the major pulping species. Only in aspen and pine did the actual cut account for more than 50% of the allowable cut.

Table 17.--Growth, allowable cut, actual cut and surplus of selected pulping species in Northern Michigan, 1955 (in 1000 cords).[a]

	Aspen	Other Hard-woods	Spruce	Balsam Fir	Red and Jack Pine	Other Soft-woods
Growth	535	753	21	62	35	190
Allowable cut	451	206	13	23	98	83
Actual cut	231	35	3	3	56	29
Surplus	220	171	10	20	42	54

[a]Findell et al., pp. 42, 45 and 46.

The pulp and paper industry has rapidly expanded since 1955, and a greater proportion of the allowable cut is taken each year. Table 18 presents the drain of selected pulping species from 1959 to 1965 as compared with the allowable cut established in 1954. From the data, it is apparent that actual cut remains below the allowable cut for most species; only in pine has the timber harvest reached the desirable cut. For all species, the actual cut was 62% of the allowable cut, which means that 38% of the desired cut was not taken, with much of it being lost from use through old age and disease. Each year, timber growth in Northern Michigan considerably exceeds the amount removed through harvest or lost to natural causes.

A survey of the pulpwood production by county reveals an unequal distribution of harvest. Although counties vary significantly in their ability to produce because of forest composition, site characteristics and amount of forest land, all but six had a growing stock exceeding one million cords in 1955. Figure 15 shows the pulpwood production by county in 1965. From the map, it appears that two areas, one extending from Benzie to Emmet Counties in the northwest and another smaller one in the southeast, produce very little pulpwood. It would seem that these areas have the greatest surplus for expansion. The data does not include the consumption of the particle plant at Gaylord,

which means the drain from Otsego and adjoining counties is higher than shown.

Table 18.--Annual drain of selected pulping species in Northern Michigan, 1959-1965 (in 1000 cords).[a]

	Total Cut[b]	Aspen	Other Hard-woods	Pine	Balsam Fir	Spruce
Allowable Cut, 1954	874	451	206	98	23	13
1959	409	263	28	104	7	7
1960	503	355	20	114	7	7
1961	450	280	51	103	9	7
1962	486	305	80	93	4	4
1963	489	314	78	84	8	5
1964	539	332	94	106	4	3
1965	539	326	100	111	2	1

[a]Data for all years preceding 1965 were obtained from Arthur G. Horn, Pulpwood Production in Lake States Counties, Lake States Forest Experiment Station Paper No. 85, September, 1960; Station Paper No. 94, January, 1962; Station Paper No. 106, December, 1962; Research Paper LS-5, December, 1963; Resource Bulletin LS-1, December, 1964; and Resource Bulletin LS-2, September, 1965. Data for 1965 were provided by the Forestry Division, Michigan Department of Conservation.

[b]Does not include consumption of the particle board plant at Gaylord.

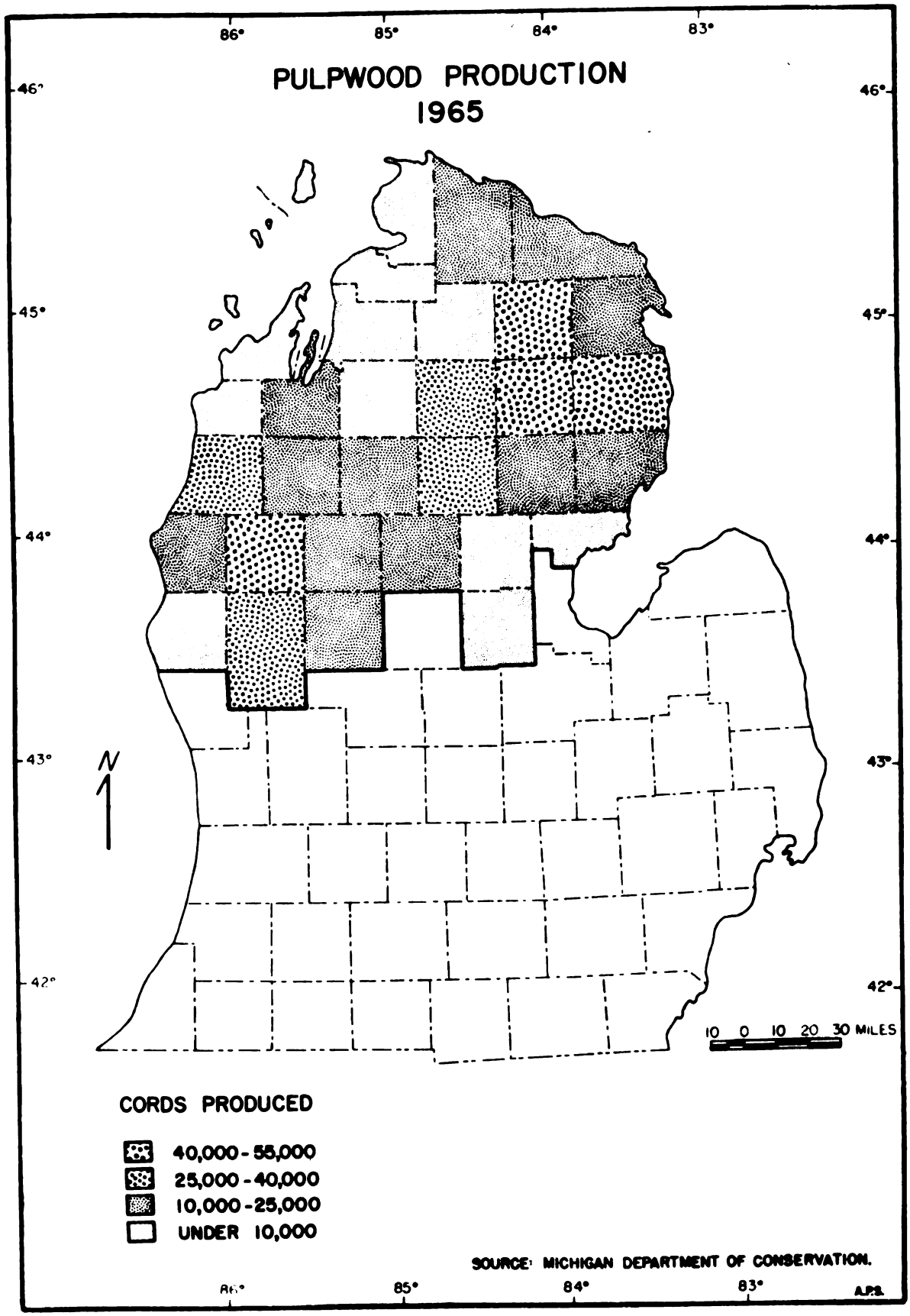
PULPWOOD PRODUCTION
1965
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
CORDS PRODUCED
40,000 - 55,000
25,000 - 40,000
10,000 - 25,000
UNDER 10,000
SOURCE: MICHIGAN DEPARTMENT OF CONSERVATION.
APS.

Figure 15

The Future Forest Resource

Although the Northern Michigan forest resource is able to support the existing pulp and paper industry, the future capability of the forest must be evaluated in order to consider the persisting contribution of the forest resource to the economy of the region. It is assumed that inter-industry competition for wood will not be a serious problem, as pulp and paper is the only important forest products industry expanding in the region.[1]

An idea of the future forest situation in Northern Michigan was obtained through an examination of a study by Christen of the capabilities of the forest of the Lake States to support an expanding pulp and paper industry with local wood. Northern Michigan's forest resource is comparable with the other forested regions of the Lake States and presently has the greatest surpluses of hardwoods. In his study, Christen estimates the pulpwood consumption of the Lake States mills for 1975 and 2000 if they were to grow to an annual rate of 3%. This assumed rate of growth falls well within the national growth projections for the industry discussed in Chapter IV and Appendix II.

Supplying the expansion of pulping capacity would require 500 million cubic feet of roundwood by 1975 and 1

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[1]This excludes the particle board plant, which is classified as a Miscellaneous Wood Industry, and the pallet industry, which uses lower-grade wood and is more market-oriented.

billion cubic feet by the year 2000. Adding consumption for lumber and other forest products industries equal to the 1959 level, a grand total of 825 million cubic feet of roundwood would be needed by 1975 and 1.35 billion cubic feet in the year 2000.[1] Using the annual growth for 1953, Christen showed that there would be a surplus of growth over projected use for all wood industries of 355 million cubic feet in 1975 and a deficit of 170 million cubic feet for the year 2000.[2] From this study and considering the growth rates and harvests in Northern Michigan, it is assumed that the forest resource has the capability of supporting a pulp and paper industry expanding at the expected national rate through 1975 and probably through the year 2000.

In Northern Michigan, there remains a virtually untapped source of wood for the present and future pulp and paper industry. Mill residue, the leftovers from the manufacture of lumber and veneer, is an important source of pulpwood throughout the United States. Bark-free slabs, edgings, trimmings and veneer cores are processed into chips and sold to the pulp mills. In 1960, the pulp mills of the Pacific Northwest obtained more than 40% of their wood supply in the

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[1] Christen, p. 127.

[2] Ibid., p. 128.

form of mill residue, with many mills using 90% chips. In the South, 11% of the pulpwood was in the form of chips.[1]

In the lower peninsula of Michigan, mill wastes were first introduced in 1964, and in 1965 four mills used residue equivalent to nearly 30,000 cords of roundwood. Discussions with mill managers indicate that the utilization of chips will show a sharp increase, probably doubling, in 1966. However, several conditions serve to limit the potential of chips in Michigan: (1) the small-size sawmills produce a low volume of mill wastes, (2) each sawmill uses several different species, which results in mill wastes that are not usable in most pulping processes, and (3) the pulp mills are equipped to handle roundwood, and expensive remodeling would be needed to allow the extensive use of chips.

Competitive Position

Although the presence of an adequate wood supply will not limit the expansion of the pulp and paper industry in Northern Michigan, several considerations regarding the forest resource may influence the competitive position of the region. The price and accessibility of the timber and the pattern of forest land ownership limit the economic supply of wood. Species limitations restrict the types of pulping operations and will be discussed in a later section.

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[1]American Forest Products Industries, Inc., Pulpwood Industry Facts, p. 3.

Although ownership of forest land is presently stable, this was not true prior to 1940. During the Depression, forest land owners were selling large acreages to the federal government at low valuations or forfeiting control of the land to the state through non-payment of taxes. Within a short time, the national and state governments found themselves owners of large but scattered forest tracts. Subsequent land exchanges have consolidated the holdings of the National and State Forests into manageable units. An examination of the present ownership pattern of the commercial forest land reveals several factors which will be of significance to the future of the pulp and paper industry in Northern Michigan.

Table 19.--Amount of commercial forest land in Northern Michigan and pulpwood production by ownership.[a]

Ownership	Acres	Per Cent of Commercial Forest Land	Per Cent of Pulpwood Production
Federal government	805,000	10.7	23
State government	1,780,000	23.7	29
Local government	20,000	.3	0
Private	4,903,000	65.3	48

[a]Schallau, pp. 2 and 5; Michigan Department of Conservation, "Volumes and Sources of Major Forest Products," unpublished table, 1965.

Although pulp and paper mills prefer to own their forest resource in order to insure continuous supply, it is apparent that a substantial share of the wood in Northern Michigan is harvested on public lands. Both the state- and federally-owned lands are significant out of proportion to their land area. The discrepancy between land area and production by various classes of ownership is largely a result of the better management of the forest on the public lands. Present National and State Forest policies are designed to increase the annual cut to the maximum level possible consistent with sustained yield management.

In total acreage, the State Forests of Michigan are the largest in the nation, and through able management and increasing annual growth, they are becoming highly important as a source of wood. As most of these lands were obtained through tax reversion, they are generally of low quality for tree growth. But through an active program of timber improvement and disease and fire control, the forest is becoming increasingly productive. On State Forest land, timber production is given equal emphasis with game management and recreation in developing management policy.[1]

Because of the plantation program initiated by the state at the turn of the century, the annual growth of several important pulpwood species is rapidly increasing.

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[1]Schallau, pp. 25-26.

Including replanted areas, over 340,000 acres of trees were planted by the state between 1904 and 1960. Through an intensive management program and the increased annual growth of softwood plantations, the State Forests will be able to account for a larger production of pulpwood in the future.

Table 20.--Net volume in forest plantation in Northern Michigan by ownership, 1957 (in 1000 cords).[a]

Species	Total	State Forest	National Forest	Private Land
White pine	42.0	13.3	3.1	25.6
Red pine	242.7	62.9	96.7	83.1
Jack pine	294.7	178.8	85.6	30.3
Spruce	5.9	3.0	0	2.9

[a]Stone and Chase, p. 19.

National Forests account for less than 11% of the commercial forest land in Northern Michigan but produce nearly one-fourth of the pulpwood (113,400 cords sold to pulp mills in 1965).[1] This results from the better condition of the forest itself and the intensive management of the resource. As in the State Forest, pulpwood is the chief timber product, accounting for over 90% of the timber volume

[1]Personal communication from John Von Bargen, June 29, 1966.

in 1964. The forest fire, disease and insect detection and control measures are similar to those in the State Forests, and the programs of the two agencies are coordinated for efficiency. Outdoor recreation, range land, timber, watershed and wildlife are all part of the National Forest management program, according to the provisions of the Multiple Use Sustained Yield Act of 1960.[1] With the increased demand for recreational space, there will be increased competition between land uses on the National Forest acreage. Table 19 indicated that private ownership accounted for nearly two-thirds of the commercial forest land in Northern Michigan but produced less than half the pulpwood. Table 21 shows the percentage distribution of private forest acreage among various occupation groups and the number of woodland owners.[2]

The considerable land held by the business-professional and wage-earner groups is characterized by absentee ownership and poor management with little or no timber harvest.[3] This is also true of the recreation group, which consists largely of camps owned by religious and social groups. In a recent survey, only 4% of the woodland owners listed timber sales as an objective, while 39% indicated

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[1] Schallau, p. 30.

[2] Woodland owner refers to an individual possessing less than 5,000 acres of forest land.

[3] Conklin refers to woodlands owned by urban dwellers as "suburban forests." H. E. Conklin, "The New Forest of New York," Land Economics, XLII (May, 1966), p. 203.

recreation or residence.[1] Timber production for these ownership categories has been low in the past, but with the increased use of land owner agreements and cooperative management plans, the productivity is increasing. Through the Tree Farm program, the pulp mills are providing professional forestry assistance.[2] This program has enabled the mills to introduce management plans on a greater portion of the lands in their procurement area and to insure long-term availability of wood.

Table 21.--Percentage of woodland owners and forest acreage in Northern Michigan by occupation.[a]

Occupation	Per Cent of Owners[b]	Per Cent of Woodland
Farmer	39	21
Part-time farmer	12	9
Forest industry	0	2
Non-forest industry	0	5
Business-professional	5	15
Wage-earner	32	11
Housewife (widow)	6	8
Recreation group	1	13
Undivided estate	0	3
Retired	3	4
Other	2	10

[a]Schallau, p. 7.

[b]0 means less than .5% reported.

[1]Schallau, p. 13.

[2]Forest land bearing the Tree Farm symbol is certified by a regional industry association after the owner has introduced a plan of forest management for timber production.

Because of the acreage involved and the generally higher quality of the land, the woodland owned by farmers probably has the greatest potential for increased production. In the past decade, the acreage in grazed woodlots and cropped land has declined, with much of the land reverting to forest. However, the farm and other woodland holdings are small in size and highly fragmented and not readily susceptible to mechanized logging operations. For this reason, their share of the pulpwood harvest will probably remain stable in the future, although absolute production will substantially increase.

About 10% of the private ownerships are in land holdings exceeding 5,000 acres. Much of this acreage is owned by large hunt clubs and camp groups.[1] As these lands are large enough for effective management and logging, they offer the pulp and paper industry the best opportunity for securing long-term wood supplies. Consumers Power Company owns 115,000 acres of commercial forest land that is managed for wood production. The company uses the allowable cut suggested by the Forest Service, annually selling between 8,000 and 10,000 cords of pulpwood.[2]

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[1] Packaging Corporation of America owns nearly 30,000 acres of commercial forest land.

[2] Personal communication from Mr. Edward Totten, Forester, Consumers Power Company, August 1, 1966.

With respect to the land ownership pattern, three problems which adversely affect the competitive position of Northern Michigan are recognized:

(1) None of the existing pulp and paper mills owns or has the opportunity of acquiring forest land. This means the mills do not have an assured source of wood at a competitive price.

(2) The quality of forest management varies widely, with much of the land not professionally managed.

(3) Many of the holdings are too small to permit the use of the more mechanized logging techniques.

Price of Wood

Regional variations in the price of pulpwood are difficult to establish because of the differences that exist within each region. Also, real costs may be hidden, as different species of wood vary in density, affecting the wood cost per ton of pulp and paper manufactured. Delivered pulpwood prices essentially reflect the local scarcity of wood, labor wage rates and the volume of wood in the forest. Limited wood supplies increase the price of stumpage[1] and as the procurement area expands, transportation costs. Higher

[1]The value of timber as it stands in the forest.

wage rates and poor stocking contribute to higher logging costs.[1]

In his analysis of regional pulpwood price differences, Guthrie noted that between 1928 and 1943, the South had the lowest wood costs, followed by the West, with higher prices in the Lake States and highest prices in the Northeast.[2] Hagenstein found wood costs highest in the Middle Atlantic and East North Central states and lowest in the South and West.[3] This apparent higher cost of wood in Northern Michigan as a part of the Lake States or East North Central States is often attributed to the higher logging costs and more recently, to the limited use of sawmill residue.

Stumpage prices are competitive in the Lake States region and have been stable over time. In 1959, producers in Michigan paid an average of $1.34 a cord for aspen and $3.46 a cord for pine.[4] Department of Conservation records indicate that stumpage prices for Northern Michigan in 1965 averaged $1.31 a cord for aspen and $3.33 a cord for pine.

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[1]Logging costs are those involved in preparing the standing tree for transport. Logging operations include felling, limbing and bucking, bark peeling and skidding to the roadside. Logging costs together with the margin for profit and risk comprise the cost of production.

[2]Guthrie, p. 145.

[3]Hagenstein, 1965 Pulpwood Annual, p. 51.

[4]Manthy and James, p. 87.

But the cost of harvesting the stumpage is higher than in the West or South. Lower per-acre yields, poor accessibility to many stands and a low level of mechanization account for the differences in logging costs. Also, because of the paucity and small size of sawmills, large quantities of mill residue are not available.

A general notion of the existing cost differences of wood between major producing regions can be calculated from census data. Using data from the 1963 Census of Manufactures, Table 22 was constructed to show the quantity, total delivered costs and average price per cord of the major pulping species. In Table 23, roundwood data from Table 22 are allocated by species to the major producing region in which the species is most intensively used.

From this data, several important regional variations are discerned. Woods used in the Lake States average out to $23.14 per cord, while those used in the South and West amount to $19.90 and $18.61 respectively. The national average for all species was $19.36 per cord. At first glance, this would indicate that the mills in the Lake States are at a competitive disadvantage with respect to wood, paying $3.24 a cord more than the southern mills and $4.53 a cord more than the western mills. Moreover, the western and southern mills use most of the relatively inexpensive wood chips and mill wastes. But these broad generalizations obscure price variances for particular mills resulting from

Table 22.--Quantity, delivered cost and cost per cord of major pulping species in the United States, 1963.[a]

Species	Quantity (in cords)	Delivered Cost (in $1000)	Cost per Cord
	Softwoods		
Spruce	3,038,115	$ 84,551	$27.25
Hemlock	1,712,626	32,983	19.25
Jack pine	783,261	17,558	22.41
Southern pine	17,798,934	360,939	20.75
Other softwoods	1,728,870	31,069	17.97
Chips	8,196,962	130,505	15.92
Mill wastes	687,887	9,251	13.44
	33,946,655	$666,856	$19.65
	Hardwoods		
Northern mixed hardwoods	1,580,603	$ 31,520	$19.94
Poplar	1,650,926	29,633	17.94
Southern mixed hardwoods	677,321	11,055	16.32
Other hardwoods	1,172,038	19,185	16.36
Chips and mill wastes	796,113	13,124	16.48
	5,877,001	$104,517	$17.78
Total	39,823,656	$771,373	$19.36

[a]Calculated from data given in U.S. Bureau of the Census, Census of Manufactures: 1963. Industry Statistics: Pulp, Paper, and Board Mills.

Table 23.--Quantity, delivered cost and cost per cord of wood by major region of utilization, 1963.[a]

Species	Quantity (in cords)	Delivered Cost (in $1000)	Cost per Cord
	West		
Hemlock	1,712,626	$ 32,983	$22.41
Other softwoods	1,728,870	31,069	17.97
Total	3,441,496	$ 64,052	$18.61
	South		
Southern pine	17,798,934	$360,939	$20.75
Southern mixed hardwoods	677,321	11,055	16.32
Other hardwoods	1,172,038	19,185	16.36
Total	19,648,293	$391,179	$19.90
	Lake States		
Spruce	3,038,115	$ 84,551	$27.83
Jack pine	783,261	17,558	20.75
Northern mixed hardwoods	1,580,603	31,520	19.94
Poplar	1,650,926	29.633	17.94
Total	7,052,905	$163,262	$23.14

[a]Calculated from data presented in Table 22.

the raw material mix consumed and the local differences in price. Illustrating the influence of species mix, a mill in Northern Michigan using equal amounts of pine and poplar (aspen) would, at national average prices, have an average wood cost of $19.35 per cord. This is competitive with the average price for wood in the South and less than one dollar per cord more than wood costs in the West.

Within the Lake States producing region, the cost of pulpwood is generally lower in Northern Michigan than for the region as a whole (see Table 24). This is probably the result of fewer mills with less competition for wood and smaller procurement areas, reducing transportation costs. In their study of pulpwood marketing in the Lake States, Manthy and James found the stumpage prices for the favored pulping species were lowest in Michigan and highest in Wisconsin.[1]

Although relative wood costs appear to be higher in the Lake States than in the West or South, Northern Michigan holds a competitive advantage within the Lake States producing region. Mills using the local pulping species such as aspen and pine have wood costs comparable with mills using roundwood in the West or South. Through greater utilization of available dense hardwoods and mill residue and increased mechanization of the logging operation, wood costs in Northern Michigan could remain competitive.

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[1]Manthy and James, p. 87.

Table 24.--Average delivered pulpwood prices in Lake States by species, 1957-1958.[a]

Location	Aspen	Other Hardwoods	Spruce	Pine
Wisconsin	$12.50	$13.00	$27.00	$17.00
Minnesota	11.00	--	24.00	15.50
Upper Peninsula	14.50	13.50	27.00	17.50
Lower Michigan	10.50	11.00	22.00	13.00

[a]U.S. Department of Agriculture, Forest Service, Feasibility of Using Lake States Hardwoods for Newsprint and Other Pulp and Paper Products (Washington, April, 1959), p. 48.

Utilization of the Forest Resource

Although Northern Michigan possesses certain advantages that will result in the region participating in the national expansion of the pulp and paper industry, the direction and magnitude of future expansion depends on the ability of the industry to utilize the available forest resource. In any producing region, the species available impose limitations on the ultimate products. Through research, the species constituting the Northern Michigan forest resource are being adapted to a greater number of pulping processes for use in a variety of grades of paper and paperboard. The Forest Products Laboratory of the Forest Service at Madison, Wisconsin, continuously experiments with the

utilization of Lake States woods in various pulping processes for various grades of paper and board.[1]

Most suitable for hardwoods under present technology are the semi-chemical and chemi-mechanical processes and the soda chemical process. The semi-chemical process has found wide acceptance in Michigan. In 1964, Michigan produced 570,129 tons of wood pulp, of which 231,252 tons, or 41%, were semi-chemical.[2] From the pulping processes most suited to the forest resource of Northern Michigan a great variety of grades of paper and board can be manufactured. Considering the market area served, several combinations of pulping processes using jack pine, aspen and other hardwoods are particularly applicable. Neutral sulfite semi-chemical pulp together with soda chemical pulp produces fine paper, book paper, and various other grades of printing paper. Other combinations of available wood and processes produce quality corrugating board, insulating board and various

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[1]The results of this research are published in the form of reports. Illustrative of these are: G. H. Chidester, Use of Hardwoods in the Manufacture of Newsprint, Forest Products Laboratory Report No. 2027, August, 1961; E. M. Davis, Paper Birch Utilization in the Lake States, Forest Products Laboratory Report No. 1953, 1959; and D. J. Fahey et al., Milk Carton Boards from Certain Lake States Softwoods and Hardwoods, Forest Products Laboratory Report No. 2187, April, 1960.

[2]Bureau of the Census, Current Industrial Reports Series: Pulp, Paper, and Board: 1964, p. 6.

types of high-grade paper.[1] Northern Michigan's competitive advantage for the pulp and paper industry lies within the production of these products, which can be manufactured from local resources and for which there is a large nearby market.

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[1] E. R. Schafer, J. S. Martin and E. L. Keller, Pulping Characteristics of Lake States and Northeastern Woods, Forest Products Laboratory Report No. 1675, Forest Service, U.S. Department of Agriculture (rev.; Madison, November, 1955), pp. 6-12.

CHAPTER VII

RELATIONSHIPS BETWEEN FOREST UTILIZATION AND ECONOMIC GROWTH AND DEVELOPMENT

Introduction

The process of forest mining has been examined, and the utilization of a managed forest resource for which a comparative advantage exists was investigated. It remains to generalize the phenomena observed in such a manner as to gain insight into the nature of the relationship between forest utilization and economic growth and development. In this chapter, the internal structural character common to forested areas is related to concepts of economic expansion and to the conceptualized models of forest resource utilization. These sequences are compared with the empirical observations of the evolution of the forest product industries in Northern Michigan. From the analyses of these relationships emerge principles which afford insight into the problem of resource utilization and the arrangement of human activity. To illustrate the character of the relationship between man and forest when the resource is managed for continuous production, the contributions of the pulp and paper industry to the Northern Michigan economy are examined. Much of the

data is presented on maps and tables illustrating the areal distribution of the direct effects of the industry. In addition, the opportunities for further research in this problem area are discussed.

Models of Forest Resource Utilization

In Chapter I, it was postulated that the relationship between forest utilization and human activity is a function of the method by which the resource is appropriated for use. Conceptually, the methods were represented by two models, each of which expressed a unique quality of the relationship between forest utilization and human activity. In the first sequence, the forest is mined and the economic inputs generated by the exploitation of the forest terminated when the resource is physically depleted. The second sequence stated that when a forest resource is managed for continuous production, the inputs influencing man's arrangement of activities persist through time. The data gathered through observing the evolution of forest product industries in Northern Michigan within this framework of mining and continuous production sequences substantiated the basic hypothesis.

The exploitation of the Northern Michigan forest resource for the lumber industry in the latter half of the nineteenth century illustrates the process of timber mining.

The region was characterized by an immature organization of economic activity with few communities or people, and circulation and service facilities were virtually nonexistent. With the rapid increase in inputs following the ascendancy of the lumber industry, a new spatial structure emerged (see Chapter II). Commercial centers were established, railroads built, social institutions and political activity organized and new personal and professional services introduced. Rapid volume growth also occurred with the addition of people, capital and industry. But when the resource was depleted, the inputs terminated. There was a subsequent contraction of all developmental elements supported by or related to the exploitation of the forest and an absolute decline in growth. As nearly the entire economy was in some fashion related to forest utilization, the decay was particularly striking.

The model of persisting inputs resulting from management of the forest resource for continuous production is illustrated by the contemporary expansion of the pulp and paper industry in the same region. Here, because of an apparent advantage for a national growth industry, the contribution is continuous and increasing. To evaluate the extent of this contribution to the economy of Northern Michigan necessitates a varied approach. The standard techniques of measuring the multiplier effect of an industry require precise data regarding employment, value added by manufacture

and input-output data linking the basic industry to all other activities. In the pulp and paper industry, the most pervasive activity is logging, which is a part-time occupation for many, with few records kept concerning the number of men engaged or time expended. Also, in the case of Northern Michigan, three of the mills process the wood to pulp and convert the pulp to paper and board products outside the region, leaving only the costs of the primary logging activities to benefit the area. Because of the immature structure of the regional economy, few of the inputs required by the industry are satisfied locally, and few of the products are marketed internally.

The only activities which occur wholly within the region are logging and transportation of wood to mills or to the defined boundary with Southern Michigan. These costs, together with the value of stumpage, contribute directly to the regional economy, influencing every county and community. It is estimated that, in 1965, stumpage alone contributed nearly $1,100,000 to the regional economy.[1] Forest land owners in all counties received a portion of this money, with owners in Crawford County sharing $84,100 and those in

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[1]Using 1965 data provided by the Michigan Department of Conservation, the average stumpage value per cord of each species was multiplied by the production in cords for the species in each county. The total value was $1,066,000, an average of $1.72 per cord.

Oscoda County $109,925 (see Figure 16).[1] If it is assumed that the production of pulpwood will increase at the rate of 3% annually, stumpage would add $1,236,000 in 1970, using current (1965) prices. By 1980, the value of stumpage would approximate $1,700,000 and would exceed $2,000,000 prior to the year 2000.

To measure the influence of logging, established indices of time and cost expended to produce a cord of wood are utilized. The problem of measuring the labor of part-time workers is approached by using estimates of man-days or man-years. Although productivity varies with the individual, the equipment, the site and the species, averages are assumed. Various authorities estimate the production of one man with a power saw at about 2.7 cords per day. This includes felling, limbing and bucking, but not bark removal or skidding to the roadside. Based on 620,000 cords produced in 1965, Northern Michigan provided 230,000 man-days of employment for cutting alone. Using the standard 200 days' work year for logging,[2] this gives a full-time equivalent

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[1]To avoid disclosing the procurement pattern of the particle board plant, only data for the pulp mills are shown. The values for Otsego and several proximate counties are therefore low.

[2]Lee M. James, Opportunities for Economic Development in Michigan's Upper Peninsula, study prepared for the Committee on Public Works, U.S. Senate (Washington: U.S. Government Printing Office, 1962), p. 31.

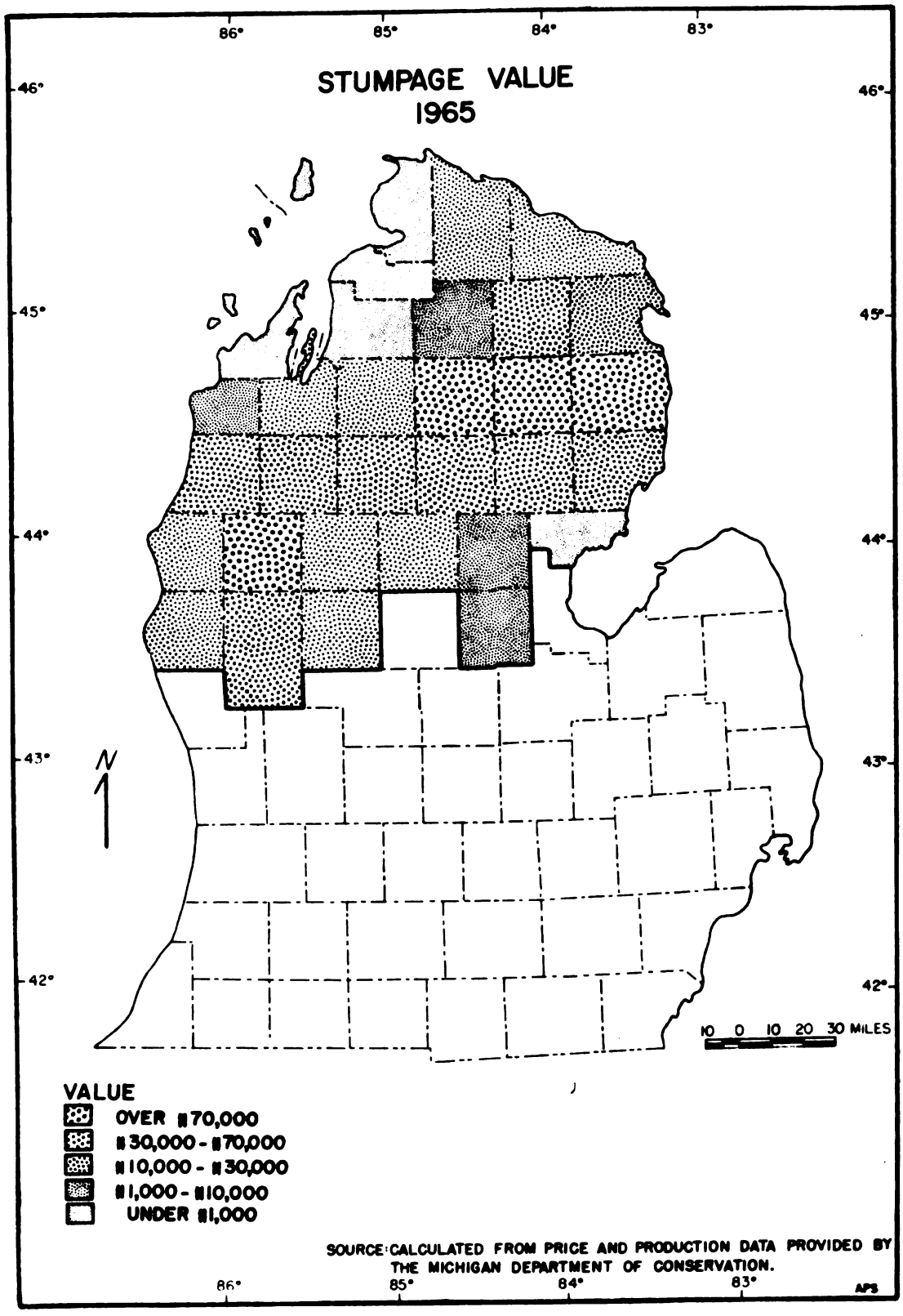
STUMPAGE VALUE
1965
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
VALUE
OVER $70,000
$30,000 - $70,000
$10,000 - $30,000
$1,000 - $10,000
UNDER $1,000
SOURCE: CALCULATED FROM PRICE AND PRODUCTION DATA PROVIDED BY THE MICHIGAN DEPARTMENT OF CONSERVATION.
APS

Figure 16

employment of 1,150 men.[1] If the labor force were to increase at an annual rate of 3%, there would be an equivalent of 1,330 full-time workers in 1970 and 1,790 in 1980. Allocating $7.40 per cord[2] for cutting and preparing the wood for barking and transport, approximately $4,600,000 was contributed to the regional economy in 1965. With anticipated growth, this would rise to over $5,300,000 in 1970 and $7,200,000 in 1980.

In 1965, an estimated 70,000 cords of wood were peeled by hand at a cost of $5.00 per cord before being transported. As all mills now have mechanical debarkers, little or no wood will be peeled by hand after 1966.[3] Although the recent introduction of new equipment makes calculation difficult, it is usually estimated that $3.00 a cord is paid for skidding the wood to roadside. At this rate, skidding contributed $1,860,000 in 1965 and would add $2,898,000 to the economy in 1980. Estimating the cost of transporting the pulpwood from roadside to mill is also

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[1]Actually, the number of men involved in cutting far exceeds this number, as most loggers work only part-time in the woods. The pulp mills using Northern Michigan wood estimate their current loggers to number in excess of 3,000.

[2]Calculated from data provided by the Michigan Department of Conservation.

[3]The history of debarking shows the pulp mills changing back and forth between using their own debarkers and buying peeled wood. With the introduction of better equipment, it is possible that the operation will return to the woods in order to avoid the transport of bark.

onerous, as the average length of haul within the region is unknown. Using an established index of $7.00 a cord,[1] transportation costs totaled $4,340,000 in 1965, and would provide $6,760,000 in 1980.

Adding the costs of stumpage, logging and transportation within the region, the total value of these activities was estimated to be over $12,200,000 in 1965 (see Figure 17).[2] The estimated contributions to the regional economy for 1965, 1970 and 1980 are summarized in Table 25.

Table 25.--Estimated contribution of primary forest activity of the pulp and paper industry to the Northern Michigan economy.

Activity	1965	1970	1980
Stumpage	$ 1,066,000	$ 1,236,000	$ 1,662,000
Cutting	4,600,000	5,325,000	7,156,000
Barking	350,000	0	0
Skidding	1,860,000	2,156,000	2,898,000
Transport	4,340,000	5,032,000	6,762,000
Total	$12,216,000	$13,749,000	$18,478,000

[1]The index of $7.00 a cord for transportation is used by the Michigan Conservation Department and agrees with a study by James and Lewis on transportation costs. See Lee M. James and Gordon D. Lewis, "Transportation Costs to Pulpwood Shippers in Lower Michigan," Michigan State University Agricultural Experiment Station, Quarterly Bulletin, XLII (February, 1960), pp. 449-69.

[2]Does not include procurement of the particle board plant.

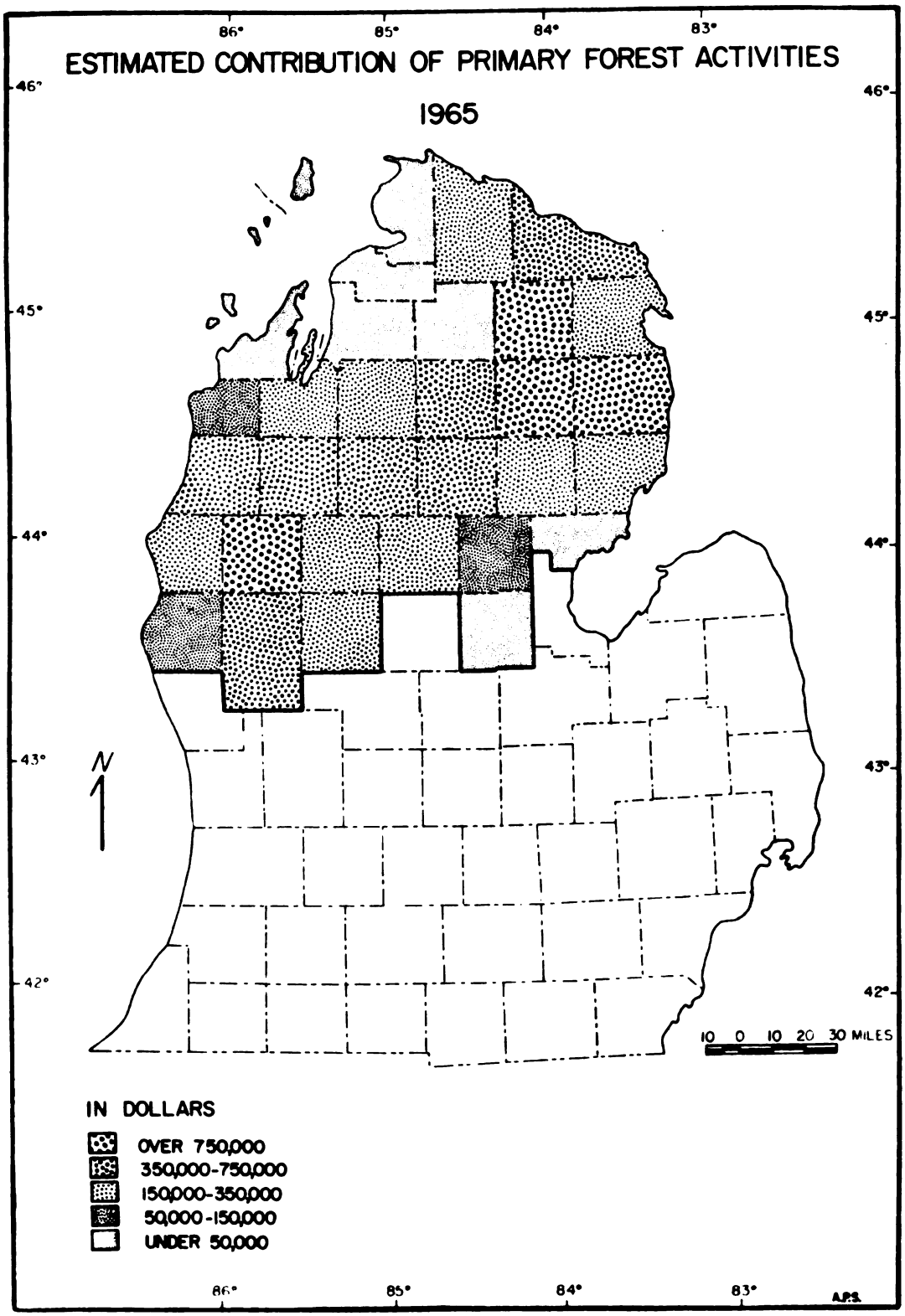
ESTIMATED CONTRIBUTION OF PRIMARY FOREST ACTIVITIES
1965
86°
85°
84°
83°
46°
45°
44°
43°
42°
N
10 0 10 20 30 MILES
IN DOLLARS
OVER 750,000
350,000-750,000
150,000-350,000
50,000-150,000
UNDER 50,000
APS

Figure 17

It is evident that logging for the pulp and paper industry contributes substantially to the economic structure of Northern Michigan. Being a space-using activity, forestry spreads the wealth to all parts of the region. Besides putting into production uncropped land and providing work for many people through logging, the management of the forest itself requires energy. The Forest Service estimates that depending on the intensity of management, between one and two men for every 1,000 acres are needed to manage forest land.[1] At the extensive limit of management, Northern Michigan would require 7,525 men to manage the resource.[2] Other forestry activities facilitate use of the land by vacationists and other non-foresters. The Michigan Department of Conservation estimates that for every 1,200 cords of pulpwood produced, one mile of woods road must be built. Using this index, nearly 520 miles of woods road were constructed for the use of the logger, hunter and camper in Northern Michigan in 1965.

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[1] Whitaker and Ackerman, p. 229.

[2] It is estimated that the equivalent of 3,100 full-time workers were engaged in managing Michigan's forest resource in 1962. See Lee M. James, "Timber Production," Part 1 of Michigan Timber Production and Industry--Now and in 1980, Agricultural Experiment Station and Cooperative Extension Service Research Report No. 38: Natural Resources, Michigan State University (East Lansing, 1966), p. 11.

Contribution of the Pulp and Paper Mills

The forest resource contributes most to society through the forest product industries, which produce goods desired by consumers. In this section, we are concerned with the benefits accruing to the communities in which these establishments are located. Unlike the primary logging activities considered previously, most of these contributions are spatially restricted to the immediate areas of the mills themselves.

The most important support given to a region in which an industry is located involves the employment provided, expenditures made locally for supplies and materials and the payment of taxes. Local expenditures are numerous and varied, including costs such as the initial investment in mill sites, buildings and plant equipment, and disbursements for wages, taxes and transportation. In addition, there are the benefits accruing from the attracting of ancillary industries linked to the basic pulp and paper mill. Also, in the case of the pulp and paper industry, there are the broad advantages derived from the possession of a growth industry that is seasonably stable in operation.

As much useful data is not released for competitive and legal reasons, it is difficult to establish an accurate measure of the local or regional impact of the pulp and paper mills. Numbers of employees and indices of value added by

manufacture provide a good estimate of the direct contribution of the industry, but the indirect influences of the industry, such as the employment generated in secondary local enterprises, are much less susceptible to measurement.

Because of the large market area in Southern Michigan adjacent to populous areas to the south, the importance of intermediate sites between the forest and the market is increased. Only two of the five pulp mills and the particle board plant are physically located in Northern Michigan. But each of these enterprises is growing rapidly and is a pacemaker of industrial development in the region. A direct contribution of these three plants to the regional economy includes the employment of a large number of local residents. However, as in nearly all manufacturing industries, progress is marked by the substituting and supplementing of human energy with inanimate machinery. Nationally, paper and board productivity rose from 103 tons per production worker in 1953 to 139 tons in 1963.[1] Because of increased automation and per capita production, the growth of the labor force has not kept pace with the growth in production. In June, 1966, the employment of the three establishments in Northern Michigan totaled 1,335 and is increasing at the rate of about 1% a year in the pulp mills.

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[1] Aubrey Wylie, "Timber Industry," Part 2 of Michigan Timber Production and Industry--Now and in 1980, Agricultural Experiment Station and Cooperative Extension Service Research Report No. 38: Natural Resources, Michigan State University (East Lansing, 1966), p. 23.

One of the best measures of the economic importance of a manufacturing enterprise is the value added by manufacture. It represents the capital addition to the value of a product through the application of labor, capital and technology.[1] Individual data are not available on the value added by pulp and paper mills in Northern Michigan, but in 1957 Kearns calculated the value added per cord of pulpwood utilized to be $349.00 for mills operating in the Lake States.[2] According to the views of forest economists, this figure remains relatively accurate, as wage and materials costs have increased to the same extent that the value of products manufactured has declined.[3] At a rate of $350 per cord utilized, the two pulp mills accounted for nearly $130,000,000 value added by manufacture in 1965.

Another measure of the support of the pulp and paper industry is the wages and salaries paid to employees. In

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[1]John A. Guthrie and William Iulo, Some Economic Aspects of the Pulp and Paper Industry with Particular Reference to Washington and Oregon, Part I of a research project entitled The Pulp and Paper Industry of the Pacific Northwest, prepared under the sponsorship of The Northwest Pulp and Paper Association, p. 88.

[2]Frank W. Kearns et al., An Economic Appraisal of Michigan's State Forests, Forestry Division Technical Publication No. 2, Michigan Department of Conservation (Lansing, 1962), p. 13.

[3]In 1957, Northern Michigan mills produced a greater amount of high-value tissue and other expensive papers than is currently manufactured. The change of products is largely the result of the expanding use of the abundant hardwood species, along with market considerations.

1962, the mills operating in Northern Michigan had a local payroll of about $7,200,000. This is in addition to any income provided the woodsworkers, as they are not employees of the mills. The payment of taxes helps support a variety of services provided by the local government. Nearly $600,000 was paid for state and local taxes by the mills in 1962.[1]

Other influences of the pulp and paper industry on the regional economy include the purchase of supplies and materials locally and the employment and income created by the expenditures of the industry employees. The industry also requires transportation, storage, marketing and financing. Because of these multiple relationships, industrial growth is cumulative, and often the output of one plant becomes the raw material for another. Cohn describes the multiplier process thus: "New factories are erected to utilize the by-products of the existing ones. Industries develop to provide supplies and machinery for expanding businesses."[2]

In the past two years, the pulpwood-using industries of Northern Michigan have added nearly 100 production workers to their payrolls. According to an oft-quoted Chamber of Commerce publication, this increase would add 359 more people

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[1]Data provided by the Michigan Department of Conservation.

[2]Cohn, p. 33.

and $710,000 more personal income a year to the region.[1] Perhaps a more refined indication of the contribution of a pulp and paper industry is provided by the Department of Commerce analysis of the input-output matrix of the industry. It was shown that nearly 20% of the dollar requirements of the paper and allied products industries were provided by other sectors of the same industry. This includes the sales of pulp to paper mills and paper and board to conversion plants. Other important sources of materials were the lumber and wood products industries, transportation and warehousing, and wholesale-retail trades.[2] But there is not a direct correlation between the growth of an industry and its multiplier effect in inducing additional economic growth within a region.[3] As most sectors of the economy are poorly developed in Northern Michigan, little of the non-wood supplies or services are acquired locally. This has substantially reduced the multiplier effect of the industry on the local economy.

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[1] Chamber of Commerce of the United States, What New Industrial Jobs Mean to a Community, research study prepared by the Economic Research Department (Washington: Chamber of Commerce of the United States, 1965), p. 4.

[2] American Paper and Pulp Association, Monthly Statistical Summary, XLIII (April, 1965), p. 17.

[3] Hans Blumenfeld, "The Economic Base of the Metropolis," in The Techniques of Urban Economic Analysis, ed. Ralph W. Pfouts (West Trenton, New Jersey: Chandler-Davis Publishing Co., 1960), p. 269.

Forest Utilization and Structural Change

Because of an apparent comparative advantage for certain segments of the pulp and paper industry, the Northern Michigan economy receives a persisting flow of inputs from the utilization of the managed forest resource. The capacity of the region to produce a good demanded by a large and expanding market and to export it at competitive prices promotes a continuous and dynamic influence by the resource. Northern Michigan's ability to satisfy a part of the Midwest's expanding demand for pulp and paper products induces a flow of income and activities into the region which persistingly alters the growth (volume change) and development (structural change) of the economy.[1] Measuring the degree of change generated by resource utilization is a difficult task, for the extent of the multiplier effect of increased inward flow of capital, goods and people on a regional economy depends on the character of the existing economic and social structure.[2]

Economic growth includes such variables as population, employment, value added by manufacture and various indices of

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[1] See Hill for a discussion differentiating between volume and structural changes in a dynamic economy. Forest G. Hill, "Regional Aspects of Economic Development," Land Economics, XXXVIII (May, 1962), p. 86.

[2] Harvey S. Perloff and Lowden Wingo, Jr., "Natural Resource Endowment and Regional Growth," in Natural Resources for Economic Growth, ed. Spengler, p. 199.

production. With the introduction of new investment is brought in a series of economic effects on the volume growth of a region.[1] As a result of the increase in the production of pulp and paper, new employment is created, and a somewhat predictable increase in volume growth occurs. Economic development has concrete manifestations in space because it involves changes in the spatial organization of human activity. The extent of structural and volume change varies with the degree of development of the existing structure.[2] Developmental changes resulting from new investment may be much less in a "mature" region already well-equipped with activity-related facilities than in an "immature" region, characterized by a low level of functional specialization. A weakly developed organization of human occupance may be replaced or greatly expanded to serve a new investment, while a more mature economy can readily accept new inputs within its existing framework. A comparison of the structural change resulting from the exploitation of the Northern Michigan forest resource for lumber in the nineteenth century with the present utilization for the pulp and paper industry illustrates this generalization.

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[1] Perloff et al., p. 93.

[2] For a detailed examination of the influence of spatial structure on economic development and, conversely, the influence of economic development on spatial structure, see John Friedman, The Spatial Structure of Economic Development in the Tennessee Valley, Department of Geography Research Paper No. 39 (Chicago: University of Chicago Press, 1955), pp. 14-16.

During the mining phase of forest utilization, a new pattern of human organization supplanted the existing eotechnic society. A completely new political, social and economic pattern was established to serve the dominant lumber industry. The result was the construction of sawmilling towns, which are the present commercial centers, logging and interregional railroads, which form the base of the existing circulation pattern, and a political organization of territorial space which survives as the contemporary townships and counties. But the structural changes following the ascendancy of the pulp and paper industry are much less pronounced. Recent expansion has necessitated the construction of a rail spur, many miles of woods road and additional water and sewage treatment facilities. No new railroads or highways have been built,[1] no new towns have emerged and political organization remains unchanged. In the first case, the poorly developed structure was replaced by a new form of organization of activity; in the latter, the existing structure is only modified, perhaps maturing, as old units are enlarged and new ones added.

In order to view another aspect of the relationship between economic growth and development and inputs added by forest utilization, examination of the existing structural organization of Northern Michigan is carried further. The

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[1]The construction of I 75 through the region is not directly related to the growth of the pulp and paper industry.

region has an extensive, rather than an intensive, development of utilities and commercial and service activities. As social overhead facilities are limited in scope, certain units such as sewage treatment plants must be enlarged as the pulp and paper industry expands. However, because of the relatively low level of development, the region is restricted in its participation in the volume change generated by the industry. The supply sources and markets of the pulp and paper industry are such that its input and output ties are almost wholly external.

Often,the most important contribution of a local industry to a regional economy is its influences on other industries and services. For the forest product industries, Dana cites the purchase of "axes, saws, tractors, planes, lathes, digesters, paper machines and other equipment" and the "sales of lumber, veneer, plywood, boxes, pulp, paper, and similar items to other industries for use in the manufacture and marketing of their products."[1] But these backward and forward linkages are external to Northern Michigan and most other forested regions. Forested areas are, by definition, extensively covered with a mantle of trees, resulting in limited agriculture or industrial activity and sparse population. Few regions dependent on forest products

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[1]Samuel T. Dana, "Forest Influences," Chapter 3 of A World Geography of Forest Resources, ed. Haden-Guest, Wright and Teclaff, p. 61.

have an organization of economic and social activity mature enough to enable them to either supply needed technology, non-wood materials and mechanical inputs or to purchase the products of the industries. Therefore, it is suggested that because of the space-using character of the forest resource, forested regions do not experience great change in economic growth or development from expansion of resource-based industry unless the inputs are supporting the initial organization of activity within the region.

It might be questioned here what advantages exist for a region to develop its forest resources if both volume and structural expansion are limited by the inherent character of forest activity.[1] Perhaps the greatest contribution of a forest resource to a regional economy is stability;[2] a managed forest resource affords the possibility of a permanent contribution. If an area possesses a comparative advantage for a nationally growing forest product industry, a persisting

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[1]Of course, there can be no question of the value of wood industries to the national economy. They create capital and perform a necessary service for society by converting trees into a variety of useful, salable goods.

[2]W. B. Greeley et al., "Timber Mine or Crop?" in Yearbook: 1922, U.S. Department of Agriculture (Washington: U.S. Government Printing Office, 1923), p. 103.

flow of inputs is assured.[1] Also, the utilization of the forest resource supplies benefits from land that might otherwise be unproductive because of soil or access limitations.[2]

Opportunities for Further Research

The geographer possesses the scope and breadth of outlook necessary to approach problems regarding the relationship of man and resources. Often, in other disciplines, research is focused on a single aspect of resource utilization; the economist may be concerned only with net return, the engineer with efficient utilization, the forester with sustained yield and the conservationist with "wise use." Grounded in the study of spatial relationships and man-land associations, the geographer considers the ecological, cultural and spatial components of resource utilization and

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[1] However, as the demand for paper and board products is derived, the industry seems to be particularly affected by downward fluctuations in business conditions. In the business slow-down of 1958 and 1959, the pulp and paper mills in Michigan operated under 85% of capacity and laid off part of their labor forces. The persisting flow of inputs conceptualized in the pattern of a managed resource is therefore dependent on economic conditions as a whole.

[2] According to Crafts and Dietz, "An important natural resource is unnecessarily wasted if there are too few wood-using industries in a particular area or if they are not diversified enough to permit full utilization of the raw material commensurate with leaving the land reasonably productive and on its way to producing another crop." Edward C. Crafts and Martha A. Dietz, "Forest Resources and the Nation's Economy," in Trees: The Yearbook of Agriculture, 1949, U.S. Department of Agriculture (Washington: U.S. Government Printing Office, 1949), p. 728.

is aware of the significance of the apparent fixed location of resources. The growth of geography as a research discipline is as much a product of the development of a formal conceptual structure as empirical investigations, and both types of research are needed to improve our knowledge of resources.

In studying the relationship between man and resources, the problem of assuring sufficient resources in the future is of paramount concern. The maintenance of high productivity and standards of living during the transition from a higher to a lower grade resource base may be seen as the critical issue. In forest land management, concern centers about man's ability to provide the quantity and quality of forest products required by a growing population, while satisfying the increasing public needs for water, forage, wildlife and forest recreation. Although scientists today believe that the total resource base will be improved as a product of technology,[1] in the past new innovation has had some negative effects on man's ability to sustain resource production. A century ago, Marsh was concerned with man's misuse of his environment; with the tools of neotechnic society, man's influence can be even more destructive. However, it does appear that current technology is oriented

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[1]For a concise discussion of the possible role of technological innovation in expanding the resource base, see Thomas B. Nolan, "Use and Renewal of Natural Resources," Science, CXXVIII (September 19, 1958), p. 632.

toward improving the supply of resources rather than merely facilitating their removal. Clawson, Held and Stoddard have observed that technological advance in forestry has changed from searching for better ways to exploit the resource to looking for improved methods of management.[1]

Another fertile area for investigation stresses the interrelationships between the plant, animal and mineral worlds. In advocating an environmental approach to conservation, Dasmann asserts that each "natural region be regarded as an organic whole and developed to provide an optimum habitat for man."[2] Supporting this approach, Weiss maintains that to single out one component of the ecological complex for study creates an artificial appraisal of the resource situation.[3] The failure of man to consider the existing interrelationships when appropriating a particular resource has often destroyed sources of food, material and energy. In mining the forest resource of Northern Michigan, the ecological balance of nature was disrupted, giving rise to

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[1]Marion Clawson, R. Burnell Held and Charles H. Stoddard, Land for the Future, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1960), p. 334.

[2]Raymond F. Dasmann, Environmental Conservation (New York: John Wiley & Sons, Inc., 1959), p. 256.

[3]Paul Weiss, Renewable Resources, a report to the Committee on Natural Resources of the National Academy of Sciences--National Research Council (Washington: National Academy of Sciences--National Research Council, 1962), p. 7.

erosion, floods and a poor quality of regrowth. For man to improve the quality of his existence, along with the new utopias of technology and industrial progress, he must consider the older notions of balance and harmony.[1]

Another problem acknowledged in this study is the inconsistent view of resources within a society. The early American settlers saw the forest both as a source of food, fuel and material and as a barrier to agriculture and communication. Only twenty-five years ago, in Northern Michigan the now valuable aspen was scoffed at as a weed. Problems of perception are of particular interest to the cultural geographer, whose methods enable him to probe the patterns of resource selection within a society. The sociologist Firey maintains that for any given people there are "resource complexes" which are not possible, others that are not adaptable and still others which are not gainful.[2] In other words, ecological, ethnological and economic considerations are all significant in studies of resource utilization. One is reminded of the popular American view of the cattle "resource" of India and the timber "resource" of Central Siberia.

A final problem area relates to the role of resources in the economic well-being of man. Research is

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[1]Arthur A. Ekirch, Jr., Man and Nature in America (New York: Columbia University Press, 1963), p. 5.

[2]Firey, p. 37.

needed concerning the differing influences of individual resources and the importance of resources in specific situations. The question arises as to the importance of the spatial character of resources in limiting or facilitating their economic influence. In this study, it was suggested that because of the spatial character of forestry, its influence on economic growth and development is limited. An example of research regarding the role of resources in specific locations is the study of the importance of the presence of falling water to economic development in Oregon. Perhaps the difference in cost of energy would have little influence on the existing industrial structure. As the role of resources in the economic well-being is poorly understood,[1] it is an area that geographers would do well to give more attention.

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[1]According to Fisher, "The role of resources in the economic growth and stability of regions is a subject upon which we have very little data, not much analysis, and therefore meager understanding." Fisher, Natural Resources, pp. 541-42.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The Nature of Resources

Resources constitute that part of the environment to which man attaches value and appropriates to satisfy his economic, social and spiritual desires. In order to facilitate a more effective utilization of the environment, man has long investigated the behavior of resources in various societies and the contribution of resources to human progress. Geographers, in particular, are vitally interested in the variable character of the landscape as it is modified through the interchange between man and his environment. One of the most rewarding approaches to this problem is the study of the activities which man pursues, using his resources, to sustain his existence and develop his economic well-being. Through viewing the relationship of man's organization of activity in space to the exploitation of resources, problems regarding the nature of various resources are probed in order to provide a better understanding of man's utilization of his environment.

One of the most important resources to our Western society, the forest, has contributed to the progress of mankind since the beginning of civilization. But geographers

have largely ignored the fertile field of forest utilization, concentrating instead on the more unique non-renewable resources. As with all resources, the forest is relative in the temporal, spatial and cultural dimensions, but the forest has been exceptionally useful to man wherever found, regardless of the society or time period. Functionally, the forest yields warmth, shelter, food, energy and material for the manufacture of goods. Because of its many and diverse uses, the forest has been termed the "universal" resource. In addition to being a highly versatile resource, the forests are renewable; with effective management, they will produce through time without being depleted. The attributes of continuous production and varied use have made the forest one of mankind's most valuable resources.

The purpose of this study was to gain a better understanding of resources through an investigation of the relationship between the utilization of the forest resource and the organization of human activity in space. It was postulated that the character of the relationship is a function of the methods used to appropriate the resource for use. The techniques of forest utilization were conceptualized as occurring in two distinct forms: in one sequence, the resource is cut without regard for future production, and in the other, it is managed for sustained yield. In the depletion or mining model, the inputs influencing man's activities in space which result from forest utilization are terminated when the

timber is removed from the landscape, while in the latter sequence, through management of the resource for continuous production, the inputs influencing the human organization of space persist through time. In order to study the processes involved in each sequence, the conduct of the Northern Michigan lumber industry between 1850 and 1910 and the pulp and paper industry following World War II were observed. These industries, which dominated exploitation of the resource in the region during their respective spans, serve as the link between the two concepts of forest utilization and the physical organization of activity in space. Through investigating the processes involved in the mining and management of the Northern Michigan forest resource, generalizations were made that reflected the reality of the relationship between man and forest utilization.

Mining of the Forest Resource

The exploitation of the Northern Michigan forest resource to supply a part of the increasing national demand for lumber during the second half of the nineteenth century was shown to closely approximate the conceptualized model of forest depletion. In the early years of the exploitation of the forest, the economy of the region experienced rapid growth with the addition of logging camps, wood-processing mills and an influx of people to man and support these primary activities. Forest industry dominated the economy,

with sawmilling providing at least one-quarter of the manufacturing employment throughout the period. It was during this time that the towns were settled, the roads and railroads constructed and the region politically organized. Lumber attracted wood products industries, storekeepers and farmers; the secondary and tertiary sectors of the economy expanded rapidly as the pace of timber mining quickened. Because of the activity-inducing inputs generated by the conversion of the resource to useful products, economic growth occurred and structural elements were added or strengthened as long as the timber remained.

But as a result of the unabated mining of the timber, the forest resource of Northern Michigan was depleted. By 1900, the commercially prominent softwoods had been cut, and within another ten to fifteen years the hardwoods also ran out. The economic activity of the region was greatly altered as the inputs resulting from forest exploitation were terminated and new means of support were sought. As the economy was centered on the forest, the region's most important resource, the decline of the economy and the contraction of the structural elements were particularly striking. There was no transition from a forest-based economy to a diversified industrial and agricultural economy. The thin soils and restrictive climate rebuffed attempts to substitute agriculture for logging, and with little opportunity for employment, the population flagged. As trade centers lost

their market, they declined in size and function, with many small lumbering communities disappearing from the landscape. The logs, lumber and other wood products had been the chief source of revenue for the railroads, and they also restricted service despite programs to develop the region for other activities. Taxes rose to support governmental and educational services for the remaining people, and subsequently much land reverted to the state when they were not paid. Forest exploitation initiated and then dominated the organization of neotechnic human activity in Northern Michigan, and when the forest was depleted, the economy virtually collapsed. The result was decay, depopulation and a severe contraction of industrial and commercial functions.

The Managed Resource as a Basis for the Pulp and Paper Industry

Because of the germination of a second-growth forest which is effectively managed for sustained yield, Northern Michigan is again able to support an expanding and economically important forest products industry. But the character of the forest has changed: the present timber resource is dominated by hardwoods such as aspen and oak instead of softwoods. Together with the shift in the composition of the resource has developed a corresponding alteration in the constitution of the forest product industries. The lesser industries include the production of lumber, veneer, charcoal

briquettes and poles. Of the numerous industries supported by the forest, pulp and paper has grown the most rapidly and has assumed a dominant position. Beginning in the region around 1890 to utilize the inferior timber left by the retreating lumber industry, the pulp and paper industry prospered until it also was unable to exist on local wood. But because of the large plant investment involved in the industry, most mills remained, operating marginally on imported wood. However, with the growth of the second-growth forest, technological innovation allowing the use of the denser local species and an increased national demand for paper and board products, the industry has flourished since World War II.

In our Western society, the concept of comparative advantage accounts for the time and place of resource utilization. The relative advantage of a region for a forest products industry influences the structural organization of the exploitation of the resource and limits the potential of the resource to contribute to the arrangement of activity in the area. In probing the enduring quality of the relationship between forest utilization and man's activities, it was postulated that based on the local timber supply, Northern Michigan holds certain advantages for the pulp and paper industry which promote a persistent contribution of the forest resource to the arrangement of human activity in the region. To facilitate the determination of the potential

contribution of the forest-based pulp and paper industry to the Northern Michigan economy, the national structure of the industry was examined and the factors which influence the spatial distribution of the industry investigated. It was found that the pulp and paper industry is a growth industry nationally and that projections for the future indicate an expectation of continued rapid expansion. In addition, through technological advancement, the species available in Northern Michigan are being adapted to several pulping processes, facilitating the production of numerous paper and board products.

Throughout its history, the pulp and paper industry has expanded its production most rapidly in those regions with the best sources of raw material consistent with the technology of the day. But the industry does not move to the least costly raw material supply unless other needed inputs are also available. The dominant locational requirements associated in space with the pulp and paper industry are wood, water, chemicals, power, labor, transportation and markets. Varying in degree of importance, these considerations are significant in locational decisions relating to all pulp and paper mills, regardless of the type of material used, the process employed to produce pulp, or the product manufactured. Northern Michigan's competitive position with respect to the rapidly growing pulp and paper industry varies with the locational requirement considered. The relative

cost and availability of water and transportation are good, while the situation with respect to fuel and labor is less favorable. The mills accept higher overall production costs in order to seek profits of large production and low mill-to-market transfer costs.

A most significant consideration in evaluating the persisting contribution of the forest resource to the organization of human activity in Northern Michigan is the capability of the resource to sustain an expanding pulp and paper industry. The character of the forest resource is in a state of constant change, but with effective management, growth continues to exceed drain. Assuming that inter-industry competition for wood will not be a problem, it appears that the forest has the capability of supporting a pulp and paper industry expanding at the expected national rate through 1975 and probably through the year 2000. Considering that technological innovation should soon allow the utilization of all species and sawmill wastes in the near future, this assumption seems very reasonable. However, several other aspects related to the forest may negatively influence the competitive position of the region. The price and accessibility of the timber and the fragmented pattern of forest land ownership all limit the economic supply of wood. In general, Northern Michigan's competitive advantage for the pulp and paper industry lies within the production

of those products which can be manufactured from locally available species and for which there exists a large nearby market.

The utilization of the Northern Michigan forest resource to support an expanding pulp and paper and particle board industry contributes substantially to the economic activity of the region. The highly pervasive primary logging activities influence every county and community within the region. It is estimated that these primary activities employed the equivalent of 1,150 men full-time and contributed over $12,200,000 to the regional economy in 1965. At an annual growth rate of 3%, they would add about $18,500,000 and employ a full-time equivalent of 1,790 workers in 1980. In addition, thousands of miles of woods roads constructed by the loggers are available to the hunter and camper. Together with the particle board plant, the pulp and paper mills employ 1,335 workers directly, and the pulp and paper mills accounted for an estimated $130,000,000 in value added by manufacture in 1965. Together, payrolls and taxes annually contribute an additional $7,800,000 to the economy. Other influences of the pulp and paper industry include the purchase of some supplies and materials locally and the employment and income created by the expenditures of the industry's employees.

Forest Utilization and Spatial Structure

The hypothesis that the character of the relationship between forest utilization and the activities of man is a function of the methods used to exploit the resource was empirically substantiated by observing the evolution of forest product industries in Northern Michigan. The exploitation of the Northern Michigan forest approximated the conceptualized sequence of a mined and managed resource. In the lumbering era, the forests contributed to the economy until they were depleted, and in the present period, sustained production through management provides a constant flow of inputs. Through examining forest exploitation in the framework of sequences of depletion and continuous production, a number of other concepts regarding forest resource utilization and the organization of human activity in space emerged. It was observed that the structural influence of the forest exploitation is related not only to the form of utilization but also to the structural character of the region. During the lumbering period, a new pattern of organization replaced the previous eotechnic society, resulting in the establishment of a completely new political, social and economic structure. But with the expansion of the pulp and paper industry, the existing structure, which evolved originally to serve a forest economy, was virtually unchanged. No new railroads or highways were built to serve

the mills, no new towns emerged and political organization remained stable. In the first case, the more primitive culture was supplanted by a new form of organization of activity, while in the latter, the existing structure is merely being modified as existing elements are altered and some new ones added.

It was also observed that the basic extensive character of the structure persisted as the utilization of the forest progressed from exploitation with no regard to the future to management of the resource for continuous production. Northern Michigan's ability to satisfy a part of the increasing demand for paper and board products induces a persisting flow of income and activities into the region that strengthens economic growth but has little measurable influence on developmental change. Because the region has an extensive development of utilities and commercial and service activities, the area is restricted in its participation in the volume change generated by industrial growth. The sources of supply and markets for the pulp and paper industry are almost wholly external, greatly reducing the multiplier effect of the industry's expansion. It was suggested that, as regions dependent on forest product industries are usually heavily forested and sparsely populated, few would have an organization of social and economic activity mature enough to enable them to supply needed technology, non-wood materials and mechanical inputs or to purchase the

products of the industries. In other words, as a result of the space-using character of forestry, forested regions do not benefit significantly from the multiplier effect of expansion in resource-based industry and are restricted in the extent of participation in economic growth and development. Only if the inputs from the growth of the forest products industry are supporting the initial organization of activity within a forested area does the region experience a significant change in volume and structure.

Although both volume and structural expansion appear to be limited by the inherent space-using character of forestry, the forest resource can provide a stable influence on a regional economy. Because the forest is renewable, a continuous production of wood for industrial use can be obtained through effective management. If an area possesses a comparative advantage for a nationally growing forest industry, a persisting flow of inputs into the regional economy is assured. In addition, the utilization of the forest resource supplies benefits from land that might otherwise be unproductive because of soil or access conditions and provides both part-time and full-time employment.

Although this study affords an elementary notion of the process through which the utilization of the forest resource influences the evolving spatial pattern of a forested region, much more work needs to be done. And the tools and method of study of geography well qualify geographers to

approach the vital questions regarding the relationship between man and resources. Problems concerned with the scarcity of resources and the use of technology in resource development are particularly important at this time. Other fields of inquiry include the perception of resources within each society and the role of resources in the economic well-being of man.

APPENDIX I

Date_____

Name of Firm_____
Address of Firm_____
_____

Name and Title of Respondent_____

A. General

1. How many years has your firm been operating at this location?_____

2. What were the principal products of your firm at this location in 1965?
   a.
   b.
   c.

3. How many full-time employees did you have at this location in 1965?_____
   How many of these were female?_____

4. How many seasonal employees did you have in 1965?_____

5. Approximately how many additional men are employed in supplying your mill?_____

6. For each of your products, indicate the percentage of the total production cost that is assessed against each of the following items. Add any costs not listed so that the total is 100%.

Wood_____	Labor_____
Chemicals_____	Management_____
Other materials_____	Capital_____
Equipment_____	Taxes_____
Depreciation_____	Other_____

7. How does the above cost structure differ from the national pattern for your product(s)?_____
   _____

B. Raw Material

1. What is the 1965 wood procurement area for your mill? List counties and, if possible, parts of counties; indicate any other states or countries. Outline area on attached map, and indicate radius of operation in miles.

_____

_____

2. Have there been any significant changes in the wood supply area for your mill over the period 1956-1965? YES____ NO____ If YES, what were the changes?

_____

_____

3. What is the ownership of the forest land from which the 1965 wood supply was obtained? Indicate by percentage.

a. Own land_____ d. National forest_____
b. Farmer_____ e. State forest_____
c. Other private_____ f. Other public_____

4. Have there been any significant changes in the wood supply obtained from different forest land ownership sources over the period 1956-1965? YES____ NO____ If YES, what were the changes, and why were they made?_____

_____

_____

C. Transport

1. What percentages of the volume of your wood receipts in 1965 were delivered to your mill by the following methods of transportation?

a. Truck_____ c. Ship_____
b. Railroad_____ d. Other (Specify)_____

2. What changes in the use of different methods of transportation for deliveries of raw wood have occurred over the period 1956-1965?_____

_____

3. What changes in the distances of haul for deliveries of raw wood to your mill have occurred over the period 1956-1965?

a. Truck deliveries_____
b. Rail deliveries_____
c. Ship deliveries_____

D. Sales

1. What was the total volume of production at your plant in 1965? List by products._____

_____

2. What percentage of plant capacity did your 1965 production represent?_____

3. What area did your sales territory cover in 1965? List by product, indicating counties or cities, states and countries. Outline area on attached map of the United States, and indicate maximum distances._____
_____
_____
_____

4. Have there been any significant changes in the product market areas for your firm over the period 1956-1965? YES____ NO____ If YES, why were the changes made and what were they?_____
_____
_____

E. Factors in Location

1. Where is your most important competitor located?_____

2. How would you rate your location as compared to his?_____
_____

3. In your opinion, could Northern Michigan support additional pulp-producing and pulp-using plants like your own?
_____
_____

Questions 4 and 5 relate to the list of factors appearing on the following page.

4. Using the following numerical scale, rate Northern Michigan with respect to the factors listed below.

1 - Excellent	3 - Fair
2 - Good	4 - Poor

5. Using the following alphabetical scale, indicate the importance you place on each of the listed factors in decisions involving expansion or relocation.
   A - Very Important
   B - Important
   C - Not important

	Northern Michigan	Importance
Presence of raw materials	___	___
Availability of information concerning the forest resource	___	___
Availability of power and fuel	___	___
Water supply	___	___
Disposal of waste products	___	___
Transportation facilities	___	___
Transportation rates	___	___
Labor supply	___	___
Labor skills	___	___
Local management and technical personnel	___	___
Wage rates and labor costs	___	___
Availability of local capital and credit	___	___
Access to markets	___	___
Relationship to established suppliers of needed raw materials	___	___
Local government restrictions	___	___
Local taxes	___	___
Overall community attitude toward industry	___	___
State taxes and policy	___	___

F. Future Development

1. If you decided to expand in a new location or move your operation, do you have any idea where you would try to locate? YES____ NO____ If YES, where?

_____

2. Indicate in order of importance those items which would influence you in expanding in your present or a new location or moving your plant.
   Resource limitation in present location_____
   Lower costs and better competitive position_____
   More advantageous location in relation to markets_____
   To avoid restrictive practices (tax, law, etc.)_____

APPENDIX II

In the 1954 study of the future growth of the pulp and paper industry by the Forest Service, a number of basic assumptions were made. The key assumptions are summarized here:

(1) There would be peace but continued military preparedness.
(2) There would be a rapid rise in population to 215 million in 1975 and 275 million in the year 2000.
(3) There will be economic prosperity and high living standards, with the gross national product rising to 630 billion dollars in 1975 and lower and upper estimates of 200 billion dollars and 1,450 billion dollars in 1975 and 2000 respectively.
(4) The total labor force will rise to 85 million in 1975.
(5) Disposable personal income will rise to 441 billion dollars in 1975.
(6) Forest products will continue to be a basic raw material, and there will be no change in the prices of these products relative to the prices of competing materials.[1]

The quantity of wood pulp required to meet the demands derived from these assumptions was determined and the quantity of wood pulp required for non-paper products estimated. Medium and upper projections for pulpwood were derived directly from the estimates of demand for wood pulp. A lower projection of demand for pulpwood was approximated from the medium projection assuming a substantial rise in the relative

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[1]Forest Service, Timber Resources for America's Future, pp. 7 and 9.

price of wood. The total demand for all paper and board products was projected for 1975 and 2000 and the demand for individual grade classes for 1975. The medium projection for each grade in 1975 was established by using the relation between trends in paper consumption and trends in gross national product, modified by past trends in particular grade classes where it was considered appropriate.

In 1964, the Forest Service revised upward its basic assumptions concerning the economy and population and issued a new set of projections. The revised assumptions were as follows:

(1) The population will reach 208 million by 1970 and 325 million by 2000.
(2) The gross national product is to rise to 1,920 billion dollars (1961 dollars) in 2000.
(3) Disposable income is to rise to 1,340 billion dollars in 2000, with per capita disposable income rising to 4,120 dollars.
(4) The labor force will rise to 82.5 million in 1970 and 126.4 million in 2000.
(5) The future price trends of timber products will not differ significantly from price trends for competing materials.[1]

Consumption estimates of the Stanford Research Institute (1954) were based on the following assumptions relating to the future size and level of the national economy:

(1) There will be no all-out war, but a high level of military preparedness will continue.
(2) There will be no radical advances in technology to increase productivity at a more rapid rate than has occurred in the past.

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[1]Forest Service, Timber Trends in the United States, pp. 5-9.

(3) There will be a greater level of stability in business cycles in future years than in the past twenty-five years with high, but not full, employment.
(4) Population will increase to 212 million by 1975.
(5) Gross national product will rise to 586 billion dollars (1952 dollars) in 1975.
(6) Disposable income payments to individuals is expected to rise to 367 billion dollars in 1975.
(7) The labor force will increase to 90.7 million by 1975, and employment will rise to 84.4 million.
(8) The price of pulp will remain in approximately the same relationship to prices of competing materials as in the past.[1]

Other studies predicting the future consumption of pulp and paper products have been undertaken by Resources for the Future[2] and Guthrie and Armstrong.[3] The projected demands in the Resources for the Future study were related with such economic variables as the total value of all goods produced, consumer purchases of non-durable goods[4] and personal disposable income. This study assumed a 1980 population of 245 million and a 1990 population of 331 million. In their study of forest product industries in 1975, Guthrie

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[1]Stanford Research Institute, America's Demand for Wood, p. ii.

[2]Hans H. Landsberg, Leonard L. Fischman and Joseph L. Fisher, Resources in America's Future: Patterns of Requirements and Availabilities, 1960-2000, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1963).

[3]John A. Guthrie and George R. Armstrong, Western Forest Industry: An Economic Outlook, published for Resources for the Future, Inc. (Baltimore: The Johns Hopkins Press, 1961).

[4]Paper itself is a non-durable good, and the major markets for its packaging and consumer grades are non-durable goods manufactures.

and Armstrong assumed that population would rise to 224 million in 1975 and the per capita consumption of pulpwood would rise from .22 cords in 1959 to .30 to .35 cords in 1975.[1]

From Table 26, it can be seen that the projections vary significantly and that for the relatively short period that has elapsed, the Stanford Report estimates are too low. The differences in the projections result chiefly from the variations in the basic assumptions of each. Considering the two key assumptions, population and gross national product, the Stanford Report was the most conservative and Resources for the Future the most liberal. Reviewing the projections in light of what has occurred in the past five years, it appears that the liberal estimates may prove to be the more accurate. However, the last five years have been decidedly above the average with respect to national prosperity. Table 27 shows the expected consumption of pulpwood to supply the demands of the expanding pulp and paper industry.

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[1]Guthrie and Armstrong, pp. 155 and 199.

Table 26.--Projected domestic consumption of paper and board products (in million tons).[a]

Year	Timber Resources	Timber Trends	Stanford Report	Resources for the Future	Actual Consumption
1960	--	--	37.4	--	39.2
1965	--	--	42.6	--	48.4
1970	--	52.7	47.9	54.9	--
1975	60.0	--	53.5	--	--
1980	--	69.3	--	76.1	--
1990	--	90.0	--	104.2	--
2000	105.0	115.5	80.0	140.7	--

[a]U.S. Forest Service, Timber Resources for America's Future, p. 433; U.S. Forest Service, Timber Trends in the United States, p. 48; Stanford Research Institute, America's Demand for Wood, p. 293; Landsberg, Fischman and Fisher, for Resources for the Future, Inc., p. 707.

Table 27.--Projections for domestic pulpwood consumption (in million cords).[a]

Year	Timber Trends		Timber Resources	Stanford Report	Guthrie & Armstrong	Actual Consumption	
	Total[b]	Dom.	Total	Dom.	Dom.	Total	Dom.
1960	--	--	--	36.0	--	48.7	40.5
1962	--	--	--	--	--	52.9	44.1
1965	--	--	--	42.2	--	--	--
1970	67.5	58.0	--	48.9	--	--	--
1975	--	--	72.0	55.4	67-78	--	--
1980	88.5	78.5	--	--	--	--	--
1990	111.0	99.5	--	--	--	--	--
2000	141.5	127.0	100.0	86.6	--	--	--

[a]U.S. Forest Service, Timber Trends in the United States, p. 59; U.S. Forest Service, Timber Resources for America's Future, p. 441; Stanford Research Institute, America's Demand for Wood, p. 324; and Guthrie and Armstrong, p. 199.

[b]Total consumption includes imports of pulpwood.

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