CHANGES IN LOCATION AND STRUCTURE
IN THE FOREST INDUSTRY
OF NORTH CENTRAL BRITISH COLUMBIA:
1909-1966

by

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B.A., University of British Columbia, 1964

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ABSTRACT

Forests and the forest industry have been dominant features in North Central British Columbia since initial settlement of the area in the 1900's. Trees have been logged and sawed into lumber to be sold to the residents of the three prairie provinces, and more recently, peeled for plywood and chipped for pulp to be exported abroad. As a result of the region's peripheral location and dependence upon these distant markets, the industry has had to adjust continuously to external pressures. Changing conditions such as expansion or contraction of markets, government decisions to build railways, changes in provincial forest management policies, and the introduction of a pulp economy to the area, have forced the industry to adapt its processes and products so that the North Central Interior could compete with other forest product regions. A gradual rationalization of the industry has occurred in both the structure and location of producing units within the region.

Several periods in the development of the industry are identifiable as a series of external stimuli, and internal responses. In its initial years, in the early 1900's, the industry consisted of a few sawmills cutting rough lumber along the upper Fraser River. Later, in the years prior to World War II, poor market conditions restricted the industry in size, technological improvement and areal spread. The buoyant market conditions of the 1940's and 1950's encouraged growth in the number of operations and dispersion of cutting operations into remote
areas. At this time, shortages of labour, equipment and capital combined with an indefinite forest management policy promoted the development of a large number of small, undercapitalized operations. The growth of large-scale production units, diversification of production and areal concentration of conversion plants have been the responses of the industry in the 1960's. A number of external forces such as changes in provincial forest management policies, changing market demands and rising labour costs have encouraged these responses.

This thesis presents an overview of the development of the forest industry, rather than concentrating upon the individual locative decision. Particular firms are used, however, to illustrate changes in structure and location which are characteristic of certain periods. Emphasis is also placed upon the role exogenous forces and traditional locative factors have played in the changes. Interviews with entrepreneurs in the area, and data from trade journals and government publications provide most of the information presented here.

The changes in size and location of producing units within the forest industry of North Central British Columbia from 1909 to 1966 are outlined first, with particular reference to external influences and industry responses. Comparisons are made of the structure and spatial patterns of the industry in 1925, 1950 and 1966. An analysis of (a) the external forces, (b) the internal adjustments of the region and, (c) the resultant pattern of location, constitutes the major part of the study. A summary of these forces, predictions of the future pattern of development and an outline of the general findings of this examination conclude the thesis.
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CHAPTER I

THE FOREST INDUSTRY OF NORTH CENTRAL INTERIOR BRITISH COLUMBIA

Significant changes have taken place in the forest industry of North Central Interior British Columbia, particularly since 1955. Logging, once restricted to lands adjacent to the railways and the upper Fraser Valley has scattered throughout the region. Conversion plants, for several years dispersed over a wide area, have again concentrated. The Prince George area, at one time the centre of the lumber production industry, now supports not only sawmills, but also plywood, pulp and paper processing facilities. A complex circulation of raw materials has resulted, in which a wide range of grades and species of logs move to conversion plants where they can be best utilized.

These changes in the pattern of the industry provide the major themes of this study. Specifically, changes in the structure and location of the industry are described and analysed. Since the forest industry dominates the economy of the area, in many cases the changes in structure of the industry have affected the area generally. Thus, this study will add to the general knowledge not only of the forest industry but also of North Central British Columbia.

A visual comparison of two maps, Log Conversion Plants in the North Central Interior in 1955 and 1964 illustrates the changes that occurred in the size, number and location of log conversion units over the last decade. Each map represents a stage in the development of the industry. In the 1950's the industry was characterized by hundreds of
small portable operations scattered throughout the timber stands of the region. There logs were felled, dragged a few yards to a crude sawing "outfit" and sawed into rough, green lumber. The lumber was loaded onto a truck and transported to a centrally-located planing mill where it was dressed, dried and marketed. Figure 1 illustrates the importance of Prince George and Quesnel as the planing centres of the region. Sawmills marketing more than one million board feet of lumber annually in 1955 are also mapped on Figure 1. These mills accounted for 85 per cent of the rough lumber produced. In addition, 300 portable mills cutting less than a million feet were scattered throughout the timber stands of the region. These mills have not been mapped because of their intermittent production and shifting locations. Only 14 integrated sawmill/planer units and one plywood mill operated in the North Central Interior at this time. There were no pulp mills.

By 1964 the industrial pattern had altered. In particular, five changes had taken place, several of which can be noted on Figure 2. There was: (1) growth in the total output of wood products (seen in the greatly increased number of producing units); (2) expansion of large-scale operations (illustrated by the presence of larger graduated circles); (3) relative concentration of all conversion units into urban centres; (4) the diversification of production (indicated by the presence of plywood and pulp and paper plants); and (5) a separation of logging

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1. Dressing is the planing of lumber to achieve smooth, even surfaces.

2. The pulp mills shown in Figure 2 have been proposed and have secured timber allotments. Construction of two of the six mills is complete. The other four mills will be operating before 1970.
Figure 1

Log Conversion Plants in the North Central Interior, 1955

Millions of feet, B.M. per annum

- Sawnmill
- Sawnmill/planer unit
- Planer mill
- plywood plant
- Number of planer mills in a given location

Source: "sawnmills and planing mills by ranger districts," British Columbia Department of Lands and Forests, Victoria, B.C., 1955
Figure 2

Log Conversion Plants in the North Central Interior, 1964

- Sawmill or sawmill-planer unit
- Planer mill
- Plywood plant
- Pulp or paper mill

and wood conversion. Only a few small seasonal lumber producers cutting less than five million feet still followed the dispersed pattern of the 1950 decade, and by 1967, even these sawmills had disappeared.

The major hypothesis of the study states that exogenous forces, particularly changes in markets for forest products from peripheral locations, determined the size and efficiency of the industry. These forces, beyond the control of the local entrepreneur, include expansion or contraction of markets, government decisions to build railways or military establishments, changes in public policies on forest management, fluctuations in lumber prices on the international market and the introduction of a pulp economy. The relative importance of these forces vary, and the influence of any particular factor shifts with the time period under investigation. Changes in the structure of the industry or location pattern are internal responses of companies within the region to these exogenous forces. Increased size of production units and their centralization in the decade 1955-65; changes in transportation technology and in the proportion of the log recovered are responses to a changing economic climate within the North Central Interior.

Methodology. The changes demonstrated in the forest industry pose questions which are most appropriate for geographic analysis. This examination of the forest industry falls into the category of traditional studies within geography which analyse the problem of industrial location in terms of factors such as proximity to raw material sources, accessibility to transportation facilities, or the availability
of a qualified labour force. However, more classical location theory is useful in developing the study as well. Three varieties of literature within the field of geography aid in the development of the methodology of this study: (a) empirical studies of industrial location, (b) classical location theory, and (c) studies of forestry and the forest industry.

Most empirical studies evaluate the major factors of location in terms of their relative importance in explaining the establishment of one or more manufacturing plants within a given region, or change in pattern of location. It is assumed the locative decision is based either on the minimization of production costs or the maximization of profit. The approach and emphasis, however, varies in these studies. Several attempt to analyse the total industrial structure of particular regions, so that major trends in their development might be isolated. Some of the studies are historical in nature, and like Lonsdale's article on the Siberian industry before 1817, examine aspects of manufacturing activity at a particular time period in the past. A few industrial


geographers such as Stafford and Harris focus upon the role of a single variable in the location of an industrial pattern. Others are essentially evolutionary, where emphasis is placed upon the dynamic nature of a particular industry, with the current industrial pattern seen as one in a series of stages. Most evolutionary studies pose basic questions: (1) What has been the change in size, number and location of industrial units? (2) How has the nature of the pattern changed (i.e., in terms of concentration or dispersion)? (3) How have the circulation patterns altered within the region? (4) What factors have been responsible for these changes, and to what degree has the role of the various locative factors changed through time? This study follows the evolutionary methodology. Within this general framework the emphasis here is upon the explanation of adjustments in location in periods of stress. This emphasis contrasts with studies such as Boas' on the American automobile industry, but follows the precedent set by the studies of Rogers and Hardwick which recognize the influence both internal and exogenous forces have had on the development of two different industries.


Views drawn from classical location theory are of use in developing this study as well. The forest processing industry (especially its extractive phases) is strongly oriented towards its raw material source. The reasons for this orientation are numerous: the raw materials used (logs) lose considerable weight and bulk during processing, the value per unit of material is relatively low, the number of raw materials used in the manufacturing processes can be reduced essentially to one, timber, and the possibility of substitution of this one essential ingredient is low. Location theory, stemming from the studies of Alfred Weber, offers theoretical evidence for wood processing plants being located within the general bounds of the supply area rather than the market area. Weber's loss of weight hypothesis states that if the raw materials of an industry lose weight in the process of manufacturing so that the finished product is substantially lighter than its raw materials then the industry will be drawn to the site of raw materials.  

The existence of the forest industry in the North Central Interior confirms Weber's hypothesis at the national scale. The various processing units, the logging "show", plywood mills, sawmills and pulp and paper plants are clearly located within a supply area (North Central British Columbia) as opposed to the market areas (the Canadian prairies, Eastern Canada and the United States). Within the region itself, however, the location of industrial plants has experienced several major

shifts, as already noted in the discussion of Figures 1 and 2. At this regional scale the degree of orientation toward the raw material source and the rationale supporting the location patterns have varied over the years and the theory becomes less appropriate. However, Weber's concept is applicable in the explanation of the shift in sawmill location since 1958.

Various other geographic concepts have been found to be useful in this study. The concept of initial advantage as used by Pred is implicit in the explanation of the relatively late development of the industry. The industries of the southern interior and coastal regions acted as intervening opportunities which delayed exploitation of the north. The concepts developed by Hoover concerning the nature of transportation costs have been applied in the discussion of the expanding hinterlands of conversion plants. Comparisons of the cost of different forms of transportation (truck, rail and water) are based on his idea that costs vary with distance and form of transport and that the most economic form for a given distance can be determined. Spatial models for the different stages in the industry's development have been constructed to illustrate the theoretical spacing of industrial units and flows of products. Losch's principles regarding market area competition have been applied. His theory that individual market


areas form a continuous hexagonal lattice when competition between entrepreneurs for the sale of goods exists has been utilized. It has been assumed that transportation costs are then minimized, every customer is served and the market areas are completely space-filling. It is argued that as competition for manufactured products and raw materials in the North Central Interior increased, the theoretical location pattern of producing units became hexagonal in nature.

Most studies of the forest industry in the field of economic geography assume that industrial units are located within supply areas and focus upon location shifts within the region. Several studies, such as Evelyn Dinsdale's examination of the lumber industry of Northern New York, are concerned with the stages of lumbering and the role technological change played in determining changes in spatial patterns. The logging technology common in the North Central Interior during the 1920's was not unlike that employed in both Eastern United States and New Zealand in the early years. However, the changes in transportation technology from horse and sled to lumber truck and thence to logging truck have been recognized here as factors permitting spatial changes to take place rather than as determining factors. They are in


fact dependent variables, closely related to the current economic climate within the region. In many cases technology employed in other regions was not introduced to the North Central Interior, or if it was, not until several years later. Consequently, emphasis is placed on exogenous factors influencing the general economic climate of the area rather than on specific technological changes which developed as a result of changing conditions.

Other studies have examined the role that raw materials have played. Usually these studies describe the existing timber resources during different time periods, and in a general way relate the resources to the existing industrial pattern. A few studies, such as Helen Hunter's, isolate a particular phase of the industry and examine the relevant locative factors. However, few concepts have been developed in these studies that have been found to have application in this investigation.

Rarely have geographic studies examined the spatial pattern of each of the phases (extraction, processing and marketing) of the industry and the relationships existing between the phases to achieve a composite view of a particular forestry region. Walter G. Hardwick,

17. The logging railway which was used extensively in other lumbering areas and which permitted the rapid liquidation of resources was never used in the North Central Interior to any great degree.


in one of the few studies of this type, traced the changes that occurred in the forest industry of coastal British Columbia from 1860 to 1960. Besides recognizing the influence that exogenous factors such as government policy and market demands had on the industry, he also examined the component parts of the industry (the raw material and waste product flows, extraction sites and conversion plants), looked at the internal functioning of the industry by tracing corporate linkages, and constructed a number of spatial models of the industry. In his conclusions, Hardwick was able to weight the relative importance of the various factors influencing location changes, and to predict future patterns to emerge in other forest industry regions as well as in Coastal British Columbia.

This study follows the precedent set by the traditional school of empirical geographic studies, particularly the one by Hardwick as outlined above. An overview of the development of an industry region is presented rather than the analysis of a particular firm. In other words, the study is concerned with the aggregate rather than the individual locative decision. Secondly, the industry is examined from an actual and specific demand and supply point of view. A primary concern is how the industry region has reacted to external pressures such as lumber and labour demands. Interviews with entrepreneurs in the area, supplemented with data from secondary sources such as early

trade journals have been used to isolate the major factors contributing to the development of the industry. Emphasis has been placed on the role the traditional locative factors played in the locative and structural changes which characterized the industry. The development of a few selected firms have been used to illustrate the trends characteristic of particular time periods. The thesis is, clearly, an empirical case study of an industry, but is one which can be used to illuminate certain features of classical location and economic theory. General location principles have been employed to relate the industrial location problem of this industry to others.

Four basic periods of development in the forest industry of the North Central Interior have been identified and the series of stimuli and responses which shaped the spatial patterns of the industry in each period have been isolated. The external forces, internal adjustments of the region, and the resultant locational pattern in each period are outlined in the following series of statements. It is proposed firstly, that exogenous forces have been most pervasive in the evolving geography of the industry:

(i) in the early years with the construction of a rail line across the region.

(ii) between 1909 and 1939 with the fluctuating market conditions and the intervening opportunity of other timber areas.

(iii) from 1940-1958 with the increased demands for lumber products, war-time shortages of labour equipment and capital, high lumber prices and the lack of a positive management policy for the forests.

(iv) after 1958 with the buoyant market conditions, rising labour costs coupled with stabilized lumber prices and changes in provincial management policies.
And secondly, it is suggested that internal adjustments and adaptations of the industry region important in developing the patterns were:

(i) minimal technological development between 1909 and 1939

(ii) the continuing high percentage of waste per log and changes in transportation technology from 1940 to 1958

(iii) the shift to full utilization of timber brought about by the introduction of pulp mills after 1958.

Finally, the patterns to develop in each period were:

(i) the establishment of speculative claims in the 1900's

(ii) the establishment of a limited number of marginal producers located proximate to the rail line between 1909-1939

(iii) a growth in the number of lumbering operations and a movement of timber cutting and sawmilling into more remote areas.

(iv) a higher per unit investment, the growth of large-scale production units, diversification of production, integration of functions and areal concentration of production after 1958.

The Study Region. The North Central Interior region of British Columbia stretches from Williams Lake in the south to the Peace River area in the north, and from the crest of the Coast Mountains in the west to the provincial boundary in the east. Local differences in the quality and type of timber stand and methods of extraction exist, but the North Central Interior as a forest industry region has a certain cohesiveness. While the Williams Lake area differs physically from the Peace River country on one hand, and the Burns Lake area on the other, all three are functionally tied together by their forest product
flows. The forces influencing the development of the industry and the responses which have been made are common throughout the area. Consequently, a meaningful region can be defined in terms of the forest industry for analysis and projection.

Forests and the forestry industry have dominated the North Central Interior landscape since the early 1900's. Logging and saw-milling provided the mainstay of the region's economy throughout the 1920's and the depression of the 1930's. However, it was not until after World War II that the production of the region began to contribute significantly to British Columbia's forest industry. The Prince George Forest District, the administrative unit that encompasses the study area, now accounts for half the interior region's forest product output.

The North Central Interior region is an area which has traditionally lacked a domestic market, and has been dependent upon the successful exportation of its wood products. This dependence has made the area particularly vulnerable to fluctuations in economic conditions of other areas. As it has already been suggested, stimulation for forest industrial development in the region has come largely from the outside. From its initial beginning in 1909, the forest industry of the North Central Interior has developed in response to a number of exogenous forces and not as a result of internal stimulation generated by existing conditions within the region.

Data Sources. The historical data presented in this study was obtained primarily from trade journals of the provincial forest industry. Development of the industry from 1909 to 1930 is described in reports.
appearing in the *Western Lumberman*. The *British Columbia Lumberman* proved to be an invaluable source of data for the years after 1930. Most of the historical records of individual companies have been destroyed, either during successive changes in ownership or through fire.

Aggregate data on the growth of the log scale and the number of conversion units was obtained from Forest Service data. Maps, including those showing size and location of conversion units in 1925, 1955 and 1964, and forest alienation in 1956 and 1964, also have been compiled from this data source. The Royal Commissions of 1945 and 1956 were used extensively for background material while the verbatim transcript of the 1956 Commission and personal interviews held in the spring of 1966 provided the basic interpretive data for the study. Most companies involved in the forest industry of the North Central Interior were willing to supply data for this study. A number of individuals were particularly helpful. Mr. Conrad Pinette, Manager of Pinette and Therrien Planer Mills Ltd. in Williams Lake, supplied general information and cost figures for the study. Mr. Harold Jacobson, General Manager, Jacobson


Brothers Forest Products Ltd. of Williams Lake outlined the development of his company in detail so that it could be used as a case study. Mr. Dennys Moore, Fulpwood Chip Buyer for Prince George Pulp & Paper Co. Ltd., was helpful in outlining the position of the various pulp companies in the area. Other interviews which were particularly valuable were given by Mr. M. Rustad, Rustad Planing Mills, Mr. G. Caine, Merton Lake Lumber, Mr. I. Killey, Fergusson Lake Lumber, Mr. W. Sterling, Quesnel Division of Weldwood of Canada, and Mr. R. Jewisson, Prince George Pulp and Paper Co. Ltd. Encouragement and helpful criticism were given by Dr. Walter G. Hardwick, Dr. J.D. Chapman, Mr. Gary E. Mullins and Mr. R.L. Dyer.

The following chapter, Chapter II, examines the changing size and location of producing units within the forest industry of North Central Interior British Columbia from 1909 to 1957. The general development of the industry during this time is first outlined, with particular reference to major influencing factors and industry responses. A comparison is then made of the structure of the industry in 1925 and 1950. Major changes in type of industrial unit and linkage between units are isolated. Two descriptive models for each of these years are presented so that differences in spatial patterns can be examined.

The contemporary stage of development of the forest industry is discussed in Chapter III. The general development of the industry since 1950 is outlined. Major structural changes are discussed in terms of functional and corporate integration. Changes in type of unit and the raw material and waste product flows are illustrated by examples.
A spatial model of the industry in 1966 concludes this chapter.

Chapter IV attempts to isolate the factors which have caused the structural and locational changes outlined in the preceding two chapters. Each period in the development of the industry is examined from the point of view of exogenous forces and internal adjustments of the region.

The concluding chapter, Chapter V, presents a summary of the basic forces that have been identified in creating the spatial patterns of the forest industry. Probable changes in the future pattern of development are suggested.
CHAPTER II

CHANGE IN STRUCTURE AND LOCATION IN THE FOREST

INDUSTRY OF NORTH CENTRAL BRITISH COLUMBIA: 1909-1957

The forest industry of the North Central Interior has experienced sporadic growth over the last 50 years. The annual volume of timber cut, when graphed, illustrates that the growth in production has taken place in a few bursts (Figure 3), while in other years there is evidence of stability and even decline. The periods of concentrated activity have been the result of forces external to the region itself. Lacking an internal market, the region has been dependent upon the development of markets in other areas. The initial flurry of lumbering before World War I, for example, was a response to the demands of the railway builders and prairie settlement. Later, during the 1920's and 1930's low demand from the prairie market retarded the growth of the industry. In 1940 an external lumber demand promoted a period of unprecedented growth in the industry. Most recently, an accessible pulpwood chip market, foreign capital and a stabilized forest management policy have stimulated the development of the industry. With each of these external stimuli, the forest industry of the region has been forced to change and adjust its internal structure and location pattern.

Four periods have been identified: Timber Speculation 1909-14; Small-scale Production in the upper Fraser Valley, 1915-1939; Areal Dispersion of Logging and Sawmilling, 1940-1957; and Functional Inte-
Figure 3

Timber Scaled in the Prince George Forest District and the Interior of British Columbia, 1919-1964.

migration and Areal Concentration of Conversion Units, 1958-1966. These periods offer a meaningful framework for both a discussion of the development of the industry and an analysis of the factors which have contributed to the structural and locational changes. This chapter examines primarily the changing size and location of producing units within the industry from 1909 to 1957. In addition, to isolate the major changes more clearly, models of the industry for 1925 and 1950 are presented and compared.

TIMBER SPECULATION: 1909-1914

Lumbering in the North Central Interior was stimulated by three exogenous factors: construction of the Grand Trunk Pacific Railway, settlement of the prairie provinces, and speculation in timber by American capitalists. Similar forces had been felt by the Southern Interior in the 1880's and 1890's. It was not until the building of the railway after 1909, however, that the North Central Interior was looked upon as a region for timber speculation and development.

The construction of Fort George, in anticipation of the rail route to the Pacific created the first sizeable local demand for lumber. As in the Southern Interior a decade earlier, small portable sawmills were established at various points ahead of the actual track laying to supply ties and bridging material, and to serve the small settlements which sprang up along the route.¹ Mills producing for export to the

prairies were to be established later.

Speculators gambled that the Grand Trunk Pacific Railway would open up the lucrative prairie market. During the late 1890's and 1900's the rate of population growth on the prairies had been spectacular. Thousands of square miles of prairies had been converted into farms, hundreds of hamlets had been established and several large centres had grown into populous cities. With the increase in population, new railways had been constructed on the prairies and old lines improved to take care of an increased volume of business. With the enormous demands on the lumber industry of British Columbia, saw mills in both the Southern Interior and on the Coast had grown and prospered. Investors hoped similar good fortune would benefit those mills in the North Central Interior.

A third factor promoting the growth of the industry of the Interior was the influx of American capital. The New England and the Southern forests had been largely depleted before the American Civil War; between 1860 and 1900, the forests of Michigan, Wisconsin and Minnesota had been mined. By the turn of the century all the traditional timber areas processing forest products for the manufacturing belt of the United States had been exhausted. As a result, the centre of the lumber industry shifted westward. Some of the midwestern lumbermen

invested in the forest land of Washington and Oregon; others looked farther north to British Columbia. These untouched stands represented the last great tracts of coniferous timber in North America, and American lumbermen rushed to gain control of any stands which might eventually prove profitable. Between 1890 and 1910 almost every available area in the province was cruised.  

The sawmills in the Southern Interior which had the initial advantage of location proximity to the prairies, had readily found new markets. The most accessible and desirable timbered districts, those in which lumber could be produced at minimal cost, attracted the foreign investors. Mills cutting up to 100,000 board feet of lumber daily were located in centres such as Fernie, Waldo, Kitchener, Nelson and Chase. A vigorous policy of indiscriminate cutting was followed. As a consequence, the areas flourished and then rapidly declined as primary lumber producers. As the country was logged off, the mills, lacking readily accessible timber, closed. By the 1920's the area was producing a fraction of what it had in 1910.

The North Central Interior was not ignored by the American investors. Timber cruisers worked farther and farther north. The speculators, in the expectation that the boom conditions of the Southern

3. Timber cruising is the initial surveying carried out to determine the volume and species of timber in a given area.

Interior could be repeated in the north, poured money into the purchase of the forest lands of the area. In 1909 the first mill established in the Prince George region was built to supply the influx of settlers with building materials. In 1911 three more mills were established by American and Eastern capitalists, one on the Fraser River and two on the Nechako. Most of the operations were relatively small compared with those which had developed in the south and were aimed at meeting the requirements of incoming settlers and railroad construction. Holdings were acquired and sawmills erected east of Prince George, in anticipation of the railway. The typical mill used a circular saw and cut twenty to thirty thousand feet of lumber daily. Oxen or horses were used in the logging "outfit" (or later a donkey engine). Usually the area exploited consisted of one or two quarter sections of timber. All the mills located in river valleys along the route of the Grand Trunk Pacific Railway. Logs were felled into the rivers and floated downstream to the mills.

A few operations were large, like that of Herman J. Rossi from Idaho, one of the prominent capitalists of the American Northwest. He headed a syndicate which secured control of some large blocks of land in the Grand Trunk Pacific belt and then acquired an additional

5. Lumberman and Contractor IV, (June 1907), p. 45.
7. A donkey engine is a stationary engine which drives cables and drums for yarding of logs in the "woods."
seventy-thousand acres in Central British Columbia. His plans called for the development of the lumbering, mining and agricultural potential of the region. Plans were laid for the building of a new town, Fraser City, near present-day Prince George. The city was expected to be a major transportation centre, with railroads joining the Grand Trunk Pacific Railway to the Peace River country in the north and the Barkerville area in the south. Large saw and planing mills were to be erected, an extensive logging railroad built and a large capacity pulp mill constructed at a later date. The collapse of the boom in 1913 brought an end both to Rossi's scheme and to most of the other proposed lumbering operations.

The survival of the interior lumber industry was dependent almost entirely upon the continuation of the prairie demand and the needs of the railway builders. Both were severely curtailed in 1913. Competition by American lumbermen for the prairie market hurt the Interior industry, and then in 1914, the start of World War I temporarily halted all immigration to Canada. The expansion of prairie settlement ceased.


9. H. R. MacMillan attributed the collapse of the lumber industry in 1913 to the slackening in building operations in the Pacific states of the United States. The American mills came to regard the prairie provinces as a "dumping ground" for all surplus products. These products were sold at greatly reduced prices. At the same time British Columbia producers were shut out of the United States markets by tariffs. Thus, the depression hit the provincial lumber industry a year prior to the start of World War I. Western Lumberman, XII (January 1915), p. 21.
The effect on the lumber industry of British Columbia was disastrous. The small local demand was insufficient to take up the slack and one by one the mills either closed or continued operation on a greatly reduced scale.

In 1914 the industry of the North Central Interior had yet to develop a firm market. Its growth had been based upon considerable speculation but very little development. Most of the mills remained small, reflecting the size of the local demand. The expectations of the investors were shattered. The favorable market conditions which had stimulated the development of the Southern Interior were not to be repeated in the north until the 1940's.

**SMALL-SCALE PRODUCTION: 1915-1939**

The number and size of the sawmills in the North-Central Interior steadily increased in the years after World War I. Most of the mills located in the spruce-Douglas fir belt of the upper Fraser Valley, east of Prince George. All were in close proximity to the prairie market and the railway. The small portable mills which had located around Prince George in 1909 and 1910 disappeared. The year 1925 has been chosen to illustrate the pattern characteristic of this period. Figure 4 shows the locational pattern to be linear, closely following

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10. The years between 1925 and 1939 were stable ones in the lumber industry, as illustrated by the fact that the number of active mills in the region increased by only 16.
LOG CONVERSION UNITS IN THE PRINCE GEORGE FOREST DISTRICT, 1925

- Sawmill

Some 1 5 10 25 30

Millions of feet B.M. per annum

Source: Forest Management Report, 1925, B.C. Forest Service
the Canadian National Railway route.  

Between 1910 and 1922 numerous mills operated intermittently on the Canadian National Railway line west of Prince George. All had closed down with the exception of the mill at Terrace which cut 35,000 feet a shift. Mills located along the Pacific Great Eastern Railway north of Williams Lake are not plotted on Figure 4, because of the incompleteness of data. Lumbering at this time in Quesnel and Williams Lake consisted of a few portable mills serving small local markets. An opening to the prairie market was to wait until the completion of the Quesnel-Prince George Pacific Great Eastern link in 1952.

East of Prince George the mills which began operating in the early 1920's dominated the industry of the North Central Interior for the next 20 years. Eagle Lake Sawmills at Giscome and the United Grain Growers' mill at Hutton both cut 25 million feet of lumber in some years. Smaller mills included the Upper Fraser Lumber Company of Dome Creek, the Aleza Lake mills, the Hansard Lake Lumber Company, the Penny Lumber Company and the Gale & Trick mill at Hansard Lake. By 1925 there were 18 mills located along the Canadian National

11. Following World War I, the Grand Trunk Pacific Railway was taken over by the Federal Government and consolidated into the Canadian National Railway.


Railway line between Prince George and the Alberta border in the broad valley of the upper Fraser, a pattern which continued until 1940.

Sawmills throughout this period continued to be closely tied to their raw material supply. In 1917 the Northern Interior correspondent for the *Western Lumberman* stated:

The policy of taking the sawmill to the timber is one that is thoroughly established. Even the larger sawmills are located in fairly close relationship to the timber supply, as a rule, and in country of rough topography where the transportation of logs is more difficult, the larger mill is replaced by the smaller settings, thus reducing the volume of waste that has to be taken over the difficult hauls in the form of lumber products.  

The Giscome mill, for example, had extensive timber limits immediately adjacent to the lake on which it was situated.

The technological level of the industry directly influenced the patterns which evolved. Until 1940 horses and sleds remained the primary means of log transport. In addition, the rivers and lakes were used for both log storage and transport. Logging operations were restricted to the distance that the logs could be moved by sled to the mill or river. Logging and milling operations, therefore, were found in close proximity.

The sawmilling industry throughout the 1920's and 1930's consisted of a few marginal producers. An unstable prairie market,


15. Timber limits refer to Crown acreage leased to a licencee under contract for removal of timber under specific contract regulations.
plus a problem of overcapacity were the causes of this situation. The lumber operations in the upper Fraser Valley were in part residuals of the previous era of American speculation. The opening years of the century had been followed by an over-zealous period of sawmill construction. The entrepreneurs' expectation of a revival of pre-World War I boom conditions failed to materialize. Until the 1940's the industry was characterized by the low output and intermittent production of large-capacity mills.

AREAL DISPERSION OF LOGGING AND SAWMILLING: 1940-1957

The war years and the post-war decade were to the North Central Interior what the turn of the century years had been to the Southern Interior. From an industry cutting 97 million feet of logs in 1925 it rose to one cutting 675 million per annum by 1956. In 1939, the Prince George Forest District reported 43 active sawmills; by 1956 the number of producing units registered 687, (Figure 5).

A sudden and sustained increase in demand for lumber stimulated this expansion. With the outbreak of the Second World War, British Columbia became a major supplier of British and Canadian war needs. Construction of air bases on the prairies became a natural market for interior producers during the early 1940's. In the years following the war, a building boom in both Canada and the United

Number of Active Sawmills
in Northern Interior, 1920-1964

Source: British Columbia Department of Lands, Forests and
States kept the demand at a high level. The result in North Central British Columbia was dispersion of producing units throughout the region.

The developments which had taken place in the area by 1955 are described in Figure 1. The capacity of the sawmills along the Canadian National Railway east of Prince George remained relatively unchanged from 1925. New operations were established in the Peace River country, the Summit Lake region around Vanderhoof and Fort Fraser in the west, and in the Quesnel and Williams Lake areas south of Prince George. Construction of transportation links to the south and north opened up these virgin timber areas. The number of large stationary sawing operations did not expand greatly during this period. By 1955 only 22 mills were producing over five million board feet of lumber annually. A major change was the growth of the small portable sawmill employing from three to eight men. With a minimal capital investment, an entrepreneur could produce lumber on a one to two million feet per year basis. The typical operation consisted of crude sawing equipment, a lumber truck and a small timber sale. With the higher lumber prices and increased demand of the 1940's and 1950's scores of people flocked to the Northern Interior to make their fortunes in the lumbering industry. In 1948,

thirty-three sawmills within a 30-mile radius of Quesnel were reported; by 1954 one hundred and eighty were operating in that same area.  

The other major change from the 1920's was the development of the planing mill and the subsequent division of labour between sawmill and planer. While the larger companies integrated saw and planing facilities, few of the portable mills were large enough to warrant the capital expenditure. A number of specialized operations which planed or dressed the rough lumber produced by portable sawmill operations developed. Many of these planing mills were a considerable size, handling the production of 30 or more portable sawmills.  

As timber cutting moved into more remote areas, the small bush sawmills followed, dispersing both milling and logging operations. Technological changes in transportation methods permitted this spread. By 1945 a change from horse and river transport to crawler tractors and truck logging had started, by 1955 it was nearly complete. The use of trucks to transport rough lumber from the sawmills to the plane lifted the areal restriction of the 1920's.

19. The planing operation is the surfacing of lumber to specific sizes so that it is smooth on either two or four surfaces.  
There evolved a pattern of dispersed logging/sawmilling units surrounding centrally-located planing mills.

The North Central Interior continued to be primarily a lumber producing region throughout the 1940's and 1950's. Western Plywood Co. Ltd. in Quesnel was the only veneer and plywood plant in the area; pulp and paper mills were non-existent. Utilization remained at a low level; all logs were sawed into lumber regardless of species or size.

STRUCTURE OF THE INDUSTRY: A COMPARISON OF 1925 AND 1950

The development and expansion of the forest industry of the North Central Interior up to 1957 has been discussed generally in terms of external influences and local responses. A detailed examination of the structure of the industry in 1925 and 1950 will help to isolate the major changes which occurred over the years. The spatial manifestations of these structural changes will be examined later.

The structure of the industry refers to the type of unit found within each phase of the manufacturing process and the functional relationship existing between all units. Industrial structure is more commonly used to refer to the mix of industries in a study area. The production of lumber comprises four distinct phases; the extractive stage when logs are felled, bucked, yarded and transported to the
conversion unit, the sawmilling phase in which logs are converted into rough lumber; the final manufacturing stage, where rough lumber is planed and finished, and lastly, the distribution stage. These are diagramatically portrayed in Figure 6. The type of unit found in each phase and the linkage existing between the unit varies. The logging operation may be large, permanent, and may function on a long term basis or it may be small, transitory in nature, and may follow a "cut and run" policy. Likewise, the sawmill may be moved from time to time as local forest resources are depleted; or it may be a large permanent operation equipped with gangsaw, edger, trimmer and re-saw. A high degree of functional integration may exist between the operations; or each unit may be completely separate and self-sustained. Between 1925 and 1950 major structural changes in terms of units and relationships between units occurred. Examples, diagrams and descriptive models are used to isolate these major changes.


21. Bucking refers to the removal of large limbs from the tree trunk. Yarding is the movement of the logs by tractor or some other means to an assembly point where they can be either loaded onto trucks or moved directly into a portable sawmill.

22. A gangsaw is a high speed saw designed to cut logs into several boards of equal thickness. An edger is a multi-saw piece of stationary equipment that is used to size rough lumber to varying but precise widths. A trimmer is used to cut defects from lumber and to trim lumber into specific lengths. A re-saw is a piece of equipment with either a circular or band saw that is used (a) to recover lumber from mismanufactured lumber, (b) to convert a cant (squared log) into lumber, or (c) to alter the thickness and/or width of a piece of lumber.
Simplified Flow of Lumber Manufacturing Process

**MARKET**

**MARKETING PHASE**

**LUMBER BROKER**

**RAILHEAD**

**SECONDARY PRODUCTION UNIT**

**PLANER MILL**

**SAW MILL**

**EXTRACTIVE PHASE**

**LOG ASSEMBLY**

**TIMBER STAND**

**POSSIBLE LINKAGES**

Finished or Rough Lumber transport by rail

Finished or Rough Lumber transport by truck

Rough Lumber transport by truck

Log transport by truck, rail, or horse and sled

Log skid by horse, arch truck or tractor
40 miles east of Prince George, illustrates the typical operation in the North Central Interior during the 1920's and 1930's. Its structure is outlined in Figure 7. The mill, operated by a group of American shareholders, was a large permanent operation, whose main product was low grade spruce lumber. In the initial years of operation the lumber was shipped as a rough, undressed product. However, the maintenance of a large lumber yard for air-drying helped increase the unit value of the lumber. Marketing and distributing was managed through sales agents across the prairies. Logging operations were carried out seasonally with up to 1½ crews hired during winter months. Logs were transported from a number of points, rather than from a single large logging camp. Because of the level of transportation technology during the 1920's, log assembly operations and the Canadian National Railway were located in close proximity.

As in the case of Eagle Lake Sawmills, corporate control of both milling and logging operations by a single holding company was the rule. In general the sawmiller logged his own limits. In contrast, on the Coast a considerable portion of the logging was carried out by independent operators who sold logs on an open market. The size of the log market and the diversity of the grades and species resulted in the development of both large scale sawmill operators and specialized producers. This diversion of labour was not feasible in the North

**Figure 7**

**INDUSTRIAL STRUCTURE, 1925**

A.

- Market
  - Railhead Wholesaler
  - Stationary Sawmill
  - Log Assembly
  - Timber Stand

B.

- Market
  - Finished or rough Lumber transport by rail
  - Railhead Wholesaler Planer mill
  - Stationary Sawmill
  - Log Assembly
  - Timber Stand

**Figure 8**

**INDUSTRIAL STRUCTURE, 1950**

- Market
  - Lumber Brokers
    - Railhead Stationary Planer
      - Log transport by tractor skid or arch truck
        - Portable Sawmill
          - Timber Stand: Log Assembly

- Rough lumber transport by lumber truck
Central region.

Logging and milling were highly complementary operations in the Interior. The logging operation was usually carried on during the winter; the milling in the summer. Unlike the Coastal situation, extensive waterways for the easy transportation of logs were not available. The two activities remained closely tied, and the linkage minimal. The seasonal flow of logs formed the only connection between operations. The sawmill and logging operations, in fact, formed a functional unit in which the mill utilized all the logs cut at the adjacent logging "show". Figure 7 illustrates this relationship and also includes the rail link with the market. The introduction of a planing unit, as in Figure 7-B, does not alter the spatial structure of the industry. The marketing function was handled by company-owned sales outlets. At this stage, no lumber wholesalers or "brokers" were necessary for the few "export" mills. Cross linkages and complexities of flows did not exist within the region; trading of logs and species between companies had not developed. Each milling/logging unit operated independently of other producers.

Structure of the Industry: 1950. During the 1940's and the early 1950's the areal spread of lumbering activity and the growth of small operators were reflected in the changing structure of the industry.

25. A logging "show" is a complete logging unit including men, equipment, roads, buildings and storage area. There, felling, bucking, yarding, sorting and transportation of logs to mill takes place. A company may fell trees on a number of fronts or "sides", and move all logs to a central assembly point.
Jacobson Brothers' mill in Williams Lake exemplifies typical operational characteristics of the era. The company began operation in 1954 as a bush mill "skidding logs in at one end and pulling slabs out the other." The equipment consisted of circular saw; the number of employees never exceeded 10; and the total capital investment was under $10,000. Green dimension lumber was trucked to planing mills in Williams Lake for finishing.

The second stage in the development of the company was the establishment of a semi-permanent mill at Horsefly, 30 miles east of Williams Lake. Logs moved to the mill from 15 miles away. Rough lumber continued to be the end product. In 1962, the Jacobson Brothers constructed their own planer at Williams Lake, supplying it with rough lumber from the mill at Horsefly. The third stage, that of complete centralization of operations was not reached until 1965 when a sawmill/planer complex capitalized at $700,000 was constructed at Williams Lake.

Most of the operations in the early 1950's followed this pattern. They were either small bush mills or larger capacity semi-permanent establishments. Capital investments ranged from $3,000 to over $300,000. In 1955 it was reported that about 17 per cent of the mills fell into the latter category, while some 600 of the total 750 active mills were of the small portable type. The mills were generally much smaller than the


28. Ibid., p. 7241.
upper Fraser mills of the previous period. The small capital investment permitted easy entry and exit into the industry. Hence, many operated for only a few months of the year, or in years of high lumber prices.

Logging and sawmilling operations remained spatially and corporately linked. The 1925 pattern continued during the 1950's. Most of the operations consisted of single logging/milling units. Only a few of the larger semi-permanent mills operated a number of logging "shows".

The division of labour occurred between the sawing of logs and the dressing of rough lumber (Figure 8). A few planing mills existed entirely upon purchased rough lumber, but many operated a number of small, portable mills to supply their needs. Rustad Bros. planing mill in Prince George, for example, had approximately 12 sawmills supplying rough lumber in 1955. Four of these, supplying a quarter of the rough lumber required, were owned by the planer. The remainder were independent operators under contract. 29 In some cases planer operators held the timber limits with independent sawmills acting as contractors. On the other hand, a number of sawmills existed that were not controlled by the planing sector. These operators sold their rough lumber to the highest bidder. A highly competitive and unstable open market for rough lumber was characteristic throughout this period.

The raw material movement of the 1950's was not dissimilar to that of the 1920's. The majority of operations skidded logs a few hundred yards directly from the stump to the mill. Very few logs were sold or traded between companies. Logging was carried out during the winter and a limited inventory of logs were kept on hand by the sawmills for summer cutting. As a result, the log flow remained basically like that of the previous period.

The change occurred with the establishment of the centralized planing mill. A general pattern of rough lumber movement from outlying sawmills into centrally-located planers was established (Figure 8). It was during these years that "planer row" in Prince George developed. The 17 planing operations which comprised "planer row" marshalled the bulk of the timber from the surrounding district, processing it and shipping it to markets in the United States, the Canadian Prairies and Eastern Canada. In 1954, of the 500 million feet of lumber produced in the district, 375 were dressed by these mills.  

In both Williams Lake and Quesnel a similar pattern evolved in which a few planing mills processed the rough lumber produced in the area. The degree of linkage existing between the individual sawmills and planers is impossible to trace in detail. Suppliers, unless corporately affiliated with the planer, changed from month to month. Sawmills operating one month could be closed down the next.

The flow of rough lumber, like the log supply of the 1920's, tended to be seasonal. In the spring during "break-up" and in the fall during "freeze-up" the roads in the area around Prince George became impassable. Most of the planer mills carried a large rough lumber inventory to assure themselves of continual operation.

SPATIAL MODELS OF THE FOREST INDUSTRY: 1925 AND 1950

Descriptive models for each of the periods have been constructed to summarize the spatial characteristics of the industrial structures outlined. These diagrams are the spatial counterparts of Figures 7 and 8. Two models have been constructed for each period: one represents the resulting pattern when a number of variables are held constant; the second illustrates modifications to this pattern when assumptions are relaxed and transportation systems introduced.

Figure 9-A represents an ideal mill layout on a flat, well-drained forested area in 1925. Accessibility, the quality of the timber supply and demand for lumber are assumed to be uniform over the area. The limited demand does not require all available timber to be exploited. The result is a random distribution of sawing/logging units. Areal restriction of log transportation forces the logging and sawmilling units to locate in close proximity. Surrounding each producing unit is an area of economic exploitation. Because of the limited demand and the subsequent lack of competition for forest land, the areas of exploitation are non-space-filling.
A. Spatial Model of the Forest Industry, 1925

- Logging/Sawmilling Units
- Log Flow
- Boundary of Log Supply Area

B. Introduction of Transportation Systems

- River
- Railway
- Logging/Sawmilling Units
- Log Flow
- Boundary of Log Supply Area
In Figure 9B, the three assumptions of equality have been relaxed and a river and railway introduced. In addition, the river valley is considered to contain the denser, more continuous growth of timber. The random spacing of industrial units characteristic of the previous diagram disappears and the units are shown to be oriented to the river valley and railway. The elongation of the areas of economic exploitation results from the extension of log transportation on rivers. The continued low demand dictates that only the "best" locations are chosen, specifically where the river and rail routes coincide. The transportation costs for both raw material and finished products are minimized.

The theoretical spatial pattern evolved by 1950 is described by Figure 10-A. Again the area is assumed to be flat, with a uniform distribution of forest stands and equal accessibility. The demand for lumber has risen and competition for forest land exists throughout the area. Product demand has resulted in the need for planing facilities. The model represents a hexagonal arrangement of portable and semi-permanent mills spaced uniformly around a central planing mill. Since log transport to the sawmills remains restricted, separate log assembly points do not develop. The movement of rough lumber a considerable distance to planing facilities has been introduced. Suggested flows of logs and rough lumber by the most direct routes are indicated. No limiting factors have been introduced and exploitation of the forest proceeds in all directions away from the mills. A broken line represents
A. Spatial Model of the Forest Industry, 1950

- Planer Mill
- Logging/Sawmilling Unit
- Log Flow
- Rough Lumber Flow
- Boundary of Log Supply Area
- Boundary of Area Exploited by Planer Mill

B. Introduction of Transportation Systems

- River
- Planer Mill
- Logging/Sawmilling Unit
- Log Flow
- Rough Lumber Flow
- Boundary of Log Supply Area
- Theoretical Area Exploited by Planer Mill Bounded by this line
- Actual Area Exploited by Planer Mill
- Railway

DKM/1966
the boundary of the area from which rough lumber can be shipped economically to the planer. When this pattern is continued, it is found that small hexagons representing the hinterlands of the portable mills "nest" within the larger hexagonal supply areas of the planers. In theory, the entire forested areas would be exploited and every portable mill would fall within the supply area of a planing mill.

Figure 10-B represents modifications to this scheme when rail, river and roads are introduced. The planer mill becomes centrally located with respect to rough lumber suppliers, but on the rail line. The sawmill/logging units are oriented to roads, for the movement of rough lumber. The regularity of the log supply areas suggests very little river transportation. The actual area exploited by the planing mills is irregular in shape as compared to the theoretical area. Road accessibility and timber stand quality determine the exact distance the lumber can be economically transported. Movement of materials within these two tributary areas (of sawmill and planing mill) has been indicated by the most direct route.

The major changes in the spatial structure of the two periods as portrayed in these models have been in the number of operations, in location of sawmills and in the introduction of the final manufacturing stage, the planing mill. Changes in transportation technology have been permissive factors allowing the spatial re-organization described in the models. A growing complexity of linkages and interdependence of units is evident in the 1950 era. The third major structural change which occurred after 1957 is examined in the following chapter.
CHAPTER III

CHANGE IN STRUCTURE AND LOCATION IN THE
FOREST INDUSTRY OF NORTH CENTRAL BRITISH COLUMBIA: 1958-1966

Since 1958, significant changes have occurred in the size, location pattern and organization of the forest industry of North Central Interior British Columbia. Three major developments have been: (1) the consolidation of the lumber producers into large-scale manufacturing units; (2) the introduction of a pulp and paper economy; and (3) the subsequent areal concentration of conversion units. Figure 2, Log Conversion Units in North Central British Columbia, 1964, illustrates these developments.

FUNCTIONAL INTEGRATION AND AREAL CONCENTRATION OF CONVERSION UNITS

The trend toward consolidation of the lumber industry into a few large-scale units was evident by the late 1950's. While the annual log scale continued to grow at a rapid rate (Figure 3), the number of active sawmills in the district decreased from a peak of 730 operations in 1955 to 450 in 1964 (Figure 5). The consolidation which has taken place since 1925 is graphically illustrated in Figure 11.

In 1925 ninety per cent of the lumber in the area was cut by 65 per cent of the mills; in 1949 the same proportion of lumber output was produced by 48 per cent and by 1964 the bulk of the
Growing Concentration of Lumber Production in the Northern Interior: 1925, 1949, 1964

Source: Compiled from Data in Provincial Forest Service Reports 1925-1965.
production was controlled by only 29 per cent of the mills. The growth of large-scale operations at the expense of the small portable mills has been brought about by (a) stable lumber prices coupled with rising labour costs and, (b) the official guarantee of long-term timber supplies. Lumber prices held constant; wages sky-rocketed. To hold costs in line, the entrepreneurs were forced to reduce the relative importance of the labour input. Increased labour productivity could only be accomplished through sizable investment in larger, more automated mills. Government legislation establishing annual timber quotas and a closed system of bidding provided the guaranteed timber supply necessary for this long-term financing. By 1964, sixty sawmills were reported cutting over five million feet of lumber annually as compared to 22 mills in that category in 1956.\(^1\) The small portable mill with low output and low wood recovery had become anachronistic.

The introduction of a pulp industry to the region is a second major change. World demand for pulp and paper products, coupled with maximization of production in other forest areas, prompted the development of a pulp economy in Interior British Columbia. The pulp mills' need for a long-term guarantee of pulp wood has been reflected in changes in governmental policy. To accommodate a pulp and paper

\(^1\) British Columbia Department of Lands and Forests, Annual Report(s) of the Forest Service (Victoria, B.C.: Queen's Printer, 1957 and 1965).
industry, and to achieve the maximum log utilization possible in the Interior, the government has introduced a third form of tenure, the Pulpwood Harvesting Area.\textsuperscript{2} As a result, pulp companies can be guaranteed long-term supplies of pulp logs.\textsuperscript{3} Six companies submitted construction proposals and have been granted the right to harvest logs in designated areas in North Central British Columbia. Once again exogenous forces created demands and influenced the industrial organization in the North Central Interior.

The capital involved in the pulp expansion comes primarily from American and European sources. Table I indicates the planned capacity of the mills, the projected completion date, the estimated capital involved, and the financial backing of each proposed enterprise. Cariboo Pulp and Paper Ltd. which is affiliated with Weldwood of Canada Ltd. in Quesnel is the only company previously involved in the forest industry of the region. Obviously, the established sawmill operators had little direct influence on the introduction of the pulp economy. A combination of world demand for pulp, the maximization of production in other forest areas, and changes in provincial management policies have encouraged the establishment of these mills.

\textsuperscript{2} A second form of tenure, the 21-year Timber Sale Harvesting Licence, has been devised to cover areas where there are no established logging operations. This tenure now covers the Finlay Public Sustained Yield Unit in the Rocky Mountain Trench area. The Pulpwood Harvesting Licence differs from the Pulpwood Harvesting Area in that the licencee has the right to harvest all timber down to a 7.1” diameter as opposed to just pulpwood species.

\textsuperscript{3} At the same time, all saw logs of these areas are reserved for the established sawmills.
<table>
<thead>
<tr>
<th>Company</th>
<th>Location of Plant</th>
<th>Estimated Investment ($ millions)</th>
<th>Annual Capacity (tons)</th>
<th>Completion Date</th>
<th>Financial Backing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prince George Pulp &amp; Paper Co. Ltd.</td>
<td>Prince George</td>
<td>$84</td>
<td>260,000</td>
<td>July, 1966</td>
<td>Joint enterprise of Canadian Forest Products Co. Ltd. &amp; Reed Paper of England</td>
</tr>
<tr>
<td>2. Intercontinental Pulp Ltd.</td>
<td>Prince George</td>
<td>$65</td>
<td>210,000</td>
<td>1968</td>
<td>Jointly financed by Prince George Pulp &amp; Paper Co. Ltd. &amp; Feldmuhle A.G. of Germany</td>
</tr>
<tr>
<td>3. Northwood Pulp Ltd.</td>
<td>Prince George</td>
<td>$56</td>
<td>210,000</td>
<td>1966</td>
<td>Financed by Noranda Mines &amp; the Mead Corp. of Dayton, Ohio</td>
</tr>
<tr>
<td>4. Bulkley Valley Pulp &amp; Timber Co.</td>
<td>Houston</td>
<td>$75</td>
<td>345,000</td>
<td>1971</td>
<td>Bowater Paper Corp. and Bathurst Power &amp; Paper Co. of Montreal</td>
</tr>
<tr>
<td>6. Alexandra Forest Industries Ltd.</td>
<td>Mackenzie</td>
<td>$80</td>
<td>260,000</td>
<td>1968</td>
<td>British Columbia Forest Products Ltd., Scott Paper Co., the Mead Corp. and Argus Corp.</td>
</tr>
</tbody>
</table>

The introduction of a pulp economy has had far-reaching effects on all phases of the forest industry. Three significant changes from the previous period are evident, of which product diversification is the most obvious. The region is no longer totally dependent upon the export of lumber. Secondly, the pattern of log utilization is changing. In the 1950's, nearly all trees cut were sawn into lumber. Now small diameter logs are directed to the manufacture of pulp; larger logs to sawmills; and peeler grades to plywood operations. Thirdly, much of what was previously waste in logging, sawmilling and plywood operations has become merchantable as pulpwood chips. Maximum log utilization can be achieved.

These changes are having important ramifications on both the structure and spatial pattern of the industry. There are significant movements toward integration of operations and areal concentration of conversion units. The pulp mills are extending the scope of their operations to both the logging and sawmilling phases of the industry. In the lumbering sector, integration of logging, sawing and planing operations is common. Fuller utilization has greatly reduced the waste proportion of each log and enhanced its transportability. Consequently, it is economically feasible to transport logs a considerable distance to sawmill/planer complexes, rather than sawing the logs initially in

\[1\] In the Interior, peeler grade logs refer to logs with a diameter (inside the bark) over 12 inches.
dispersed sawmills and transporting rough lumber to centralized planers. Conversion units are locating at various points along the rail line. The small outlying sawmills, typical of the 1950's, are disappearing: the large-scale, centralized plants are expanding. Units coming into production since 1956 have been integrated planing/sawing operations, pulp mills or plywood plants. Emerging from these changes are the integrated conversion centres of Prince George, Quesnel, and Williams Lake (Figure 2). The lumber conversion centres of Fort St. James, Vanderhoof, Fraser Lake, Smithers and Chetwynd assume secondary importance.

STRUCTURE OF THE INDUSTRY: 1966

The most important changes in the structure of the forest industry have taken place since 1960. Integration between the various phases has been a key factor to these changes. Integration, both functional and corporate, has directly affected the type of unit and the linkages existing between the units. Examples within the lumber manufacturing sector and the forest industry as a whole will be examined to describe the changes that have taken place.

The Fort St. John Lumber Company Ltd. of Chetwynd illustrates the pattern followed by many of the successful lumbering operations. The company, formed in 1943, has grown from a small bush mill into an operation producing 60 million feet of lumber annually and
indirectly employing 330 people. During the 1950's a large capacity planing mill at Chetwynd provided the nucleus of operations. Bush mills scattered throughout the Peace River area supplied the mill with rough lumber. Timber holdings were controlled by Fort St. John Lumber Co. Ltd., but a large portion of the initial sawing was contracted to independent operators.

In 1964 Canadian Forest Products Ltd. acquired the mill and subsequently closed the bush mills and centralized all sawing facilities at the planing mill. Over two million dollars has been spent in modernizing and diversifying production units. High speed automatic equipment has been installed throughout. Logs are weight-scaled and stored in a large dry-pond area; barking and chipping facilities have begun to manufacture pulpwood chips; a new "chip-n-saw" machine now handles all small logs. Logging is carried out on a contract


6. Weight scaling is a new time-saving method used to measure the volume of wood in any one log. By this method the average scale of each truck-load is determined by its weight.

7. A dry-pond is the area in which logs are stored and sorted. In early years most logs had been stored in lakes, in a mill-pond. Most storage now takes place on dry land in the area adjacent to the mill.

8. The "chip-n-saw" is a new smallwood machine which will mass-produce lumber and pulpwood chips simultaneously from logs under 14 inches in diameter.
basis with all logs delivered by truck to the Chetwynd complex. The lumber output is sold through the sales department of the parent company\(^9\) and pulpwood chips are delivered to the affiliated pulp mill in Prince George.\(^{10}\) Productivity per employee has increased and economic log utilization has been introduced since the centralization and integration of the company.

The path of development taken by Fort St. John Lumber Company Ltd. is common in the North Central Interior. The need for integration between the extractive site and conversion plant appears to have been realized from the beginning. Most sawmilling and/or planing operations ensured themselves of a continued log flow by purchasing timber sales. It is between the extractive and marketing stages, however, that significant changes are occurring. The division of labour between sawmills and planers which existed in the previous period has already disappeared. Joint ownership of sawing and planing facilities by a single company is the rule.\(^{11}\) Secondly, specialization of production in terms of either long lengths\(^{12}\) or studs\(^{13}\) is taking place. Both

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9. Lumber is sold through Eburne Sawmills, Division of Canadian Forest Products Ltd.

10. Canadian Forest Products Ltd. has an interest in Prince George Pulp and Paper Ltd. in Prince George.

11. One mill in Quesnel and two in Prince George still exist primarily by custom planing for other lumber companies.

12. Long lengths refer to lumber which is over 20 feet in length. A mill specializing in long lengths usually does not handle short logs of any type.

13. Studs refer to lumber 2 inches by 4 inches and cut to specialized lengths, usually between 7-1/2 and 8-1/2 feet.
manufacturing processes may be found in the large operations, or alternatively, in two smaller mills which are functionally integrated. Thirdly, logging is being contracted to independent operators and a division of labour between sawmillers and loggers is evident. And finally, corporately affiliated sales outlets are taking over the marketing function performed by the independent wholesalers in the 1950's.

Other major corporate changes which have affected the industry result from the extension of pulp companies into the lumber and plywood sectors. The companies are seeking to integrate operations horizontally as well as vertically. Besides controlling logging, pulp manufacture, and marketing phases, the companies wish to enter the other wood-manufacturing processes. Three factors are prompting this trend: (a) the need for fuller utilization of each log, (b) the realization of economies of free log exchange among corporately linked manufacturing units, and (c) the need for control over that part of the pulpwood chip supply which comes from plywood and sawmill waste. ¹₄

The degree of integration and the form it will take varies with company policy. Differences can be seen in the integration processes of Canadian Forest Products Ltd. and Northwood Pulp Ltd. Canadian Forest Products Ltd., the parent company of Intercontinental Pulp Co. Ltd. and Prince George Pulp and Paper Ltd. (see Table I), has recently established its timber position in the Peace River and Stuart Lake areas. Fort St. John Lumber Company Ltd. in Chetwynd and Riverbank

Sawmill Ltd. in Fort St. James have been acquired. When Pulpwood Harvesting Area #1 was secured by Canadian Forest Products Ltd., the company was restricted from entering the lumber industry in the immediate vicinity of Prince George. Consequently, the pattern evolving is one of areally dispersed production units controlled by subsidiary firms.

In order to build up their timber position, Northwood Pulp Ltd. is also acquiring established sawmill operations. Northwood Mills Ltd. was formed in 1961 "...to acquire sawmills and related timber quota in the interior of British Columbia." In that year, Upper Fraser and Sinclair Spruce Sawmills were purchased. In May of 1966 the large Eagle Lake Sawmill at Giscome was acquired. The mills will eventually be sold to Northwood Pulp Ltd. for co-ordination and consolidation. The company's long-range plan calls for the construction of a large capacity sawmill and plywood plant adjacent to the pulp mill. Unlike the Canadian Forest Products Ltd. interests, Northwood Pulp Ltd. will eventually direct all logs to an integrated complex in Prince George.

15. As a safeguard for the established sawmills in the area it was agreed that Prince George Pulp and Paper Ltd. would not enter the sawlog operating business within its harvesting area. "Pulpwood Harvesting Area No. 1 Agreement," between the Minister of Lands, Forests and Water Resources and Prince George Pulp & Paper Ltd. (November 22, 1962), p. 5.

16. Mr. Adam Zimmerman, Proceedings of Public Hearings "In the Matter of the Proposal Made by Northwood Mills Ltd. for a Pulpwood Harvesting Area to Include the following Sustained Yield Units in the vicinity of Prince George, namely (Prince George, B.C., May 28, 1964), p. 12.

17. Ibid., p. 13.
In other areas similar trends toward the complete integration of forestry operations are evident. The project of Alexandra Forest Industries Ltd. at Mackenzie includes the immediate construction of pulp, plywood and lumber manufacturing facilities. The lack of pre-established sawmilling operations in the area committed the company to the construction of all three phases of the industry.

Integration does not necessarily entail joint ownership. A functional relationship whereby a given product of one independent operation is directed to another can also be referred to as integration. In the North Central Interior the industry is still composed of a number of independent sawmills who maintain pulpwood chip contracts with the pulp mills. Co-operative integration rather than corporate integration is still present to a considerable degree.

Integration at the corporate level has brought about a complex circulation system within the industry. Figure 12 illustrates the producing units and the linkage existing between them. Two flows are evident: the raw material flow from the logging operations to the conversion plants and the waste material flow from plywood and sawmill operations to the pulp mills. An examination of the facilities for handling the flows and the routes taken by the transportation of materials follows. The Weldwood operation in Quesnel will serve as an example of the changing raw material flow. The waste-product flow will be illustrated by the pulpwood chip flows to both Northwood Pulp Ltd. and Prince George Pulp and Paper Co. Ltd.
Figure 12

INDUSTRIAL STRUCTURE, 1966

Linkages

Market

Sales Outlet or Broker

MARKETING PHASE

Dressed lumber transport by rail

Railhead

Planer Mill

Sawmill

Plywood Mill

Pulp and Paper Mill

SECONDARY PRODUCTION UNIT

Pulpwood chip flow by rail or van

Sorted logs transported by fork lift truck

Log flow by truck

Timber Stand Log Assembly

EXTRACTIVE PHASE
Raw Material Flow. The Cariboo Division of Weldwood of Canada Ltd. located in Quesnel consists of centralized conversion facilities supplied by a number of outlying logging shows. Weldwood holds quotas in seven sustained yield units and one forest management licence, plus cutting privileges in the Special Sales Area. In addition, Cariboo Pulp and Paper Ltd., an affiliated company, was awarded Pulpwood Harvesting Area #5. Figure 13 illustrates the log flow which supplies their sawmill, planer, stud mill and plywood complex. The company transports logs by river, rail and truck. Thirty-five per cent of the total raw material supply comes from the Forest Management Licence and Quesnel Lake Sustained Yield Unit. These logs are driven 45 and 65 miles down the Quesnel and Fraser Rivers. A few peeler logs come by rail from the Lac La Hache area to the south, but most of the remaining log supply is trucked to the conversion units and then directed to its most economic use.

This pattern, whereby logs are brought from a great many sources, over a variety of transportation media to a centralized operation is characteristic of the 1960's. It is evident in numerous sawmilling towns on a functionally co-operative basis. Located in Williams Lake are stud mills, a veneer plant, and several dimension sawmills, one of which specializes in long lengths. The log supply area for the mills surrounds the town, extending a hundred miles in

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Figure 13

Annual Log Flow to Weldwood of Canada Operations in Quesnel

Cottonwood S.Y.U. = Source of Log Flow

Log Flow, 1/4" equals 1,000,000 Cubic Feet

Source "A Counter Proposal For the Establishment of a Pulp Mill in the Vicinity of Quesnel" Cariboo Pulp and Paper Co. Ltd. (mimeographed), December, 1964
Considerable log trading between companies occurs. Peeler grade logs are directed to the Merrill Gardner Ltd. veneer plant; large dimension sawlogs to Jacobson Brothers Forest Products Ltd.; and small dimension logs to the Pinette & Terrien stud mill. In the future, pulpwood logs may be harvested and chipped by the mills for the pulp companies.

The raw material flow of the pulp mills forms a similar type of pattern. Pulpwood logs come to the mills by truck and rail from a number of logging operations in the companies' Pulpwood Harvesting Areas. Again, a centralized conversion plant served by a large supply area is characteristic.

Three methods of log transport are used in the North Central Interior: rail, truck and river. Because timber stands currently being exploited are not located proximate to railway routes most of the logs are transported by truck. Less than a million feet of timber was moved by the Pacific Great Eastern Railway in 1965. Much of this movement was temporary until new conversion facilities are completed or until another form of transportation is available.

The rail extension north of Prince George to Fort St. James will carry the first major rail movement of logs in the area. Pulpwood

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will be transported to Prince George Pulp and Paper Ltd. and Intercontinental Pulp Co. Ltd. from Harvesting Areas #1 and #7 at a cost of 7¢/100 lbs.²¹

Some of the log movement is by river driving.²² Logs are driven in the Quesnel and Fraser Rivers south of Prince George; in the Upper Fraser River west of Prince George; and between Trembleur and Stuart Lakes via the Tachie River. Logs are also towed eastward across Francois Lake and driven annually down the Stellako River to Fraser Lake. Where a choice of transportation methods exists a comparison of costs is made.

In a comparative cost study of river driving and truck hauling,²³ it was found that log movement by river is cheaper. Because extra savings and expenditures accrue to both methods irrespective of the actual transportation of the logs, the total logging operation was examined. Common log costs were felling, limbing, yarding and skidding, bush decking, loading into the lake, scaling, booming and towing, slash disposal, road construction (bush roads) and admin-

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²² Trees are fell and stored in the woods until spring when the rivers are at their highest. The logs are then dumped into the river and moved by the current downstream. At a designated point, the logs are caught and lifted out of the river.

65

stration. These amounted to a basic $16.50 per hundred cubic feet (Ccf) for each transportation system. Additional logging costs for river driving of $1.70/Ccf result from bucking, scaling, booming and towing. On the other hand, expenses for truck loading and unloading and extra capital investments amount to $2.90/Ccf for transporting logs by truck. Therefore, a saving of $1.20 is realized by the river driving system, irrespective of the cost of transportation. Gains are also made in the movement of logs by water. Two hypothetical examples based on these cost figures have been derived:

A. Ten-mile log movement

Saving in logging costs of river driving system .......... $1.20 Ccf
Transportation cost differential ........................ $1.25 Ccf
Cost of truck haul $2.50/Ccf
Cost of river drive $1.25/Ccf
Total savings of river driving system ................. $2.45/Ccf

B. Fifty-mile log movement

Savings in logging costs of river driving system ........ $1.20 Ccf
Transportation cost differential ...................... $6.25 Ccf
Cost of truck haul $12.50/Ccf
Cost of river drive 6.25/Ccf
Total Savings of river driving system ............... $7.45/Ccf

The cost of river driving is approximately half that of truck hauling. As the distance the logs are moved increases, transportation by river becomes even more attractive. Therefore, the hinterland of the conversion unit can be extended considerably wherever log trans-
portation by water is feasible. On the other hand, with river driving, large storage areas are needed and the log flow to the mill becomes much more erratic.

Log storage facilities in the North Central Interior are located in lakes, rivers or mill yards. To the north and west of Prince George and in the Quesnel and Williams Lake areas, the roads become impassible for two months in the spring during "break-up" and in the fall just before "freeze-up." For a third of each year, a large proportion of the log flow to the mills is interrupted. Consequently, a considerable inventory of logs must be kept on hand by the mills. The majority of operators store their logs in the area immediately adjacent to the mill, the dry pond. Large areas of log storage are found in conjunction with sawmills north of Quesnel in the Two Mile Flat area and in the Pacific Great Eastern Industrial Site in Prince George. Both Prince George Pulp and Paper Co. Ltd. and Northwood Pulp Ltd. have storage areas adjacent to their mill sites. However, no major log storage area comparable to the coastal booming grounds in the Fraser River exists in the area.

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Sorting and scaling are the initial processes through which the logs pass. Both activities are costly and time consuming. With the increased volume of logs being handled by the mills more efficient methods are being introduced. One of the developments which appears most promising is that of bulk scaling by weight. By conventional methods, the load was dumped, spread, and each log scaled individually. Weight scaling involves "the recording of each truckload of timber, subtraction from this of the unloaded truck weight and the application of a formula involving weight and scale in cubic feet of a selected sample of the timber being scaled." This type of scaling reduces both the labour and time involved, as well as the area required for spreading the logs.

Pulpwood Chip Flow: Since 1965 a growing number of sawmills have started manufacturing pulpwood chips. Both Prince George Pulp and Paper Co. Ltd. and Northwood Pulp Ltd. began stockpiling chips two years ago. For the manufacture of pulpwood chips, sawmills must install two additional pieces of equipment, a "barker" and "chipper."

25. Scaling refers to the measurement of the volume and quality of wood in each log.


27. All pulpwood chips are manufactured from bark-free waste. Bark cannot be used in the manufacture of sulphate pulp.
The mechanical barker is a device whereby the log is passed through a rotating head and the bark removed by a shearing action. In the chipping machine, wood is brought into contact with blades attached to a disc spinning at high speeds. Over 30 barking/chipping units have been installed in mills since 1965; most in mills cutting over 15 million feet of lumber annually. For the mills installing this equipment, the sale of pulpwood chips is a new source of income. With the current prices, however, many operators consider the manufacture of chips to be a marginal venture.

The development of a pulpwood chip flow in the region is a direct result of the pulp companies seeking a cheap raw material source. Mr. J.E. Liarsch of Prince George Pulp and Paper Co., Ltd. stated:

The only possibility of overcoming the inherent disadvantages of an interior location compared to a tide-water location (reference to pulp mill) in the overseas markets is to obtain our wood (pulp logs and pulpwood chips) at a cost per-ton-of-pulp lower than the cost in Coast operations.

Smallwood logging in the area is still in the experimental stages and the exact cost is yet unknown. On the other hand, pulpwood chip prices are known and have been set at approximately $10.00 a unit.

28. On the Coast hydraulic barkers are used. The hydraulic barker is a device by which logs are stripped of bark by coming in contact with a high-pressure water jet.


Consequently, the pulp mills are using chipped wood waste for part of their raw material supply. The per cent of purchased chips used varies from mill to mill. Half of the raw material supply of Northwood Pulp Ltd. comes from sawmill waste; none of Intercontinental Pulp Co. Ltd.'s supply comes from this source.

The 1965-66 pulpwood chip flow in the North Central Interior is illustrated in Figures 14 and 15. Approximately half a million units of chips moved to the two pulp mills in Prince George. It is expected that chip production in the area will increase by at least 175,000 units within the next few years as more sawmills install chipping and barking facilities. On both maps the flows from the area south of Prince George dominate. There the similarity ends. Northwood Pulp Ltd. receives about 30 per cent of its supply from the mills in the upper Fraser Valley. In contrast, the largest single chip supplier of Prince George Pulp and Paper Ltd. is Ft. St. John Lumber Co. Ltd. in Chetwynd.

The two flows shown in Figures 15 and 16 are by no means stabilized. Both pulp companies will lose a number of their chip suppliers when the pulp mills in Quesnel and Houston begin operation. Pulpwood Harvesting Area #4 gives Bulkley Valley Pulp and Timber Co. Ltd. access to timber in the Babine and Francois Lake areas. The sawmills in Smithers, Telkwa, Topley, Burns Lake and Endako who

Annual Pulpwood Chip Flow to Prince George Pulp and Paper Co. Ltd. (March, 1966)

Pulpwood Harvesting Area 1 (awarded to P.G.PandP Co. Ltd.)
Pulpwood Harvesting Area 7 (awarded to Intercontinental Pulp Co. Ltd.)
Flow of Chips - 1/8" equals 10,000 B.D.U.'s

Source: Compiled from B.C. Forest Service Mimeographed Lists of Annual Lumber Production of Mills. Conversion Factor of .5 used to estimate Chip Production

Figure II
Annual Pulpwood Chip Flow to Northwood Pulp Co. Ltd. (March, 1966)

- Pulpwood Harvesting Area 3 (awarded to Northwood)
- Flow of chips: 1/8" equals 10,000 B.D.U.'s

Source: Compiled from B.C. Forest Service Mimeographed Lists of Annual Lumber Production of Mills. Conversion Factor of 5 used to estimate Chip Production.
also draw their raw materials from this area can be expected to
direct their chip production to the Houston mill. Considerable
savings in freight charges would be realized. A similar re-
orientation will take place south of Prince George. Milling operations
in Williams Lake, Quesnel, 100 Mile House, Lone Bute and Lac Hache
will probably market their pulpwood chips in Quesnel. A change from
the Pacific Great Eastern Railway's flat rate of $2.10/unit to one
based on distance would facilitate this re-orientation. The future
pattern of pulp wood chip movement can be projected as a series of
directed flows focussed upon four major centres. Prince George, by
virtue of the number of pulp mills located there, will dominate.
Quesnel, Houston and possibly Mackenzie will form secondary centres.

Almost all the pulpwood chips in the region are transported to
Prince George in specially constructed chip cars. The Canadian
National Railway rates for chip movement are based on distance. From
Fort Fraser, 80 miles west of Prince George, $2.62 per unit is
charged; from Houston, 112 miles farther west, the rate is $6.56 per
unit (see Table II). In contrast, the Pacific Great Eastern Railway
has set a flat rate of $2.10 per unit for all shipments to Prince
George. The rate for chips moving to the Coast via the Pacific
Great Eastern has recently risen from $3.50 to $10.00 per unit.


33. Each car carries from 28 to 32 units of pulpwood chips.
One bone-dry unit contains 200 cubic feet of chips.
### TABLE II: Pulp Wood Chip Freight Rates

#### A. Via the Pacific Great Eastern Railway:

<table>
<thead>
<tr>
<th>Wood Chips</th>
<th>From</th>
<th>To</th>
<th>In Cents Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carload Minimum</td>
<td>Williams Lake</td>
<td>North Vancouver</td>
<td>10.00</td>
</tr>
<tr>
<td>28 Units per Car in 5600 cubic feet capacity cars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum in 5600 cubic ft. Capacity Car, 28 Units per Car</td>
<td>Chetwynd</td>
<td>Clinton</td>
<td>Davie</td>
</tr>
<tr>
<td>Minimum in 6100 cubic ft. Capacity Car, 32 Units per Car</td>
<td>Dunkley</td>
<td>Exeter</td>
<td>Kennedy</td>
</tr>
</tbody>
</table>


#### B. Via the Canadian National Railways:

<table>
<thead>
<tr>
<th>Wood Chips</th>
<th>From</th>
<th>To</th>
<th>In Cents Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carload Minimum</td>
<td>Crescent Spur</td>
<td></td>
<td>3.06</td>
</tr>
<tr>
<td>1,000 lbs. based on 32 Units per Car</td>
<td>Fort Fraser</td>
<td>Fraser Lake</td>
<td>Houston</td>
</tr>
</tbody>
</table>

*Source: Commodity, Application and Rates in Cents Per 100 lbs. Wood Chips, Canadian National Railway, Feb. 4, 1966.*
Although the price for pulpwood chips is higher on the Coast ($18.00/unit compared with $10.00/unit in the Interior), the additional freight charge prohibits the movement of chips south. Consequently, the pulp mills in the North Central Interior are not compelled to compete with Coast pulpwood chip prices.

The chip-van, a motor vehicle with a capacity of 21 units, is the alternative method of transportation for pulpwood chips. Currently, only one mill, located 35 miles from Prince George, is transporting chips by van. Studies in Eastern Canada have shown that trucks are used more frequently on shorter hauls, while rail movement is more economical for larger distances (Figure 16). In the future, it is probable that more conversion plants in the immediate vicinity of Prince George may use vans for moving their chip production.

The structure of the forest industry in 1966 presents a vivid contrast to that in 1955. Conversion units have become highly complex; linkages between the units intricate. The North Central Interior is finally reaching its full potential as a forest products manufacturing region.

**SPATIAL MODEL OF THE FOREST INDUSTRY: 1966**

Two models comparable to those of 1925 and 1950 have been constructed to summarize the spatial pattern of 1966. The first represents the pattern resulting when a number of variables are held constant; the second, the modified pattern when transportation and topographical elements are introduced.
Figure 16

Frequency of Truck and Rail Hauls of Sawmill Chips by Distance in Eastern Canada.

Source - I.B. Flonn, "How Sawmill Chips are Moved in Eastern Canada," Forest Products Research Branch, Department of Forestry, 1964
The theoretical spatial pattern evolved by 1966 is described by Figure 17-A. Like the 1950 model, the area is assumed to be flat, with a uniform distribution of forest stands and equal accessibility. The demand for forest products is high: competition for forest land exists throughout the area. Change in product demand since 1950 has resulted in the addition of a pulp economy to the area. No limiting factors have been introduced and exploitation of the forest proceeds in all directions from the conversion units. Placement of the boundaries of exploitation has been determined by the distance logs and pulpwood chips can be economically transported. The model resulting is comprised of a hierarchy of three hexagonal systems. At the highest level, pulp mill, sawmill/planing and plywood operations form conversion centres which dominate the area. Individual conversion units (either sawmill/planer or plywood units) are spaced uniformly about the conversion complexes and direct flows of pulpwood chips to the centres. At a second level, the individual conversion units are the focus of hexagonal areas of log exploitation. Logs are direct to these units from evenly spaced log assembly points. Logs are also directed from assembly points to the conversion centres in the same manner. At the third level, each log assembly point is surrounded by an area from which logs can be drawn. The hinterlands of log assembly points nest within the supply area of the individual conversion units, which in turn make up the tributary areas of the integrated conversion centres.
A. Spatial Model of the Forest Industry, 1966

Secondary Log Flow to Mills
Log Assembly Point
Saw and Planer Mill
Integrated Pulp, Lumber and Plywood Complex
Log Flow
Pulpwood Chip Flow
Boundary of Log Supply Area
Boundary of Area Exploited by Sawmill
Boundary of Chip Supply Area of Pulp Mill

B. Introduction of Transportation Systems

Railway
River
Log Assembly Point
Saw and Planer Mill
Integrated Pulp, Lumber, and Plywood Complex
Log Flow to Assembly Point
Secondary Log Flow to Mills
Pulpwood Chip Flow
Boundary of Log Supply Area
Boundary of Theoretical Area Exploited by Sawmill
Actual Area Exploited by Sawmill
Figure 17-B represents modifications to this scheme when rail, river, and roads are introduced. The conversion complexes and individual conversion units become centrally located with respect to both log and chip supplies. The planer/sawmill or plywood operations, however, tend to form nodes rather than being evenly distributed along the rail line. These units are no longer oriented to roads as they were in the 1950's. The hinterlands of the conversion plants are irregular in shape, varying with the quality of timber stand and degree of accessibility. The chip supply area extends equally in all directions.

Major changes from the 1950 pattern are increases in log transportation distances, relocation of conversion units and the emergence of integrated conversion centres. In addition, the complexity of linkages and interdependence of processes has increased significantly. The factors prompting these changes are isolated and weighted as to their relative importance in the following chapter.
CHAPTER IV

AN ANALYSIS OF KEY FACTORS CONTRIBUTING TO THE
CHANGES IN STRUCTURE AND LOCATION IN THE FOREST
INDUSTRY OF NORTH CENTRAL BRITISH COLUMBIA

A number of changes in the structure and location in the forest industry of the North Central region of British Columbia have been isolated and the spatial patterns characterizing the three major periods summarized. Factors such as growth markets, availability of capital, government policies and technological changes have contributed to the changes in the patterns. This chapter attempts to explain the locational changes by weighting the factors according to their relative importance. Exogenous forces influencing the general economic conditions of the region (i.e., encouraging the industry either to grow, decline or stabilize) are considered first. The examination of forces affecting the selection of industrial sites, and hence bringing about changes in location within the region, follows.

SMALL-SCALE PRODUCTION

1915 - 1939

The major factor which encouraged the initial exploitation of timber in the upper Fraser Valley was development of the prairie market. Throughout the 1920's and 1930's this market continued to be the dominating factor, structuring both the size and type of industrial
development. The technological level of the industry and the raw material supply of the region dictated the area in the North Central Interior to be exploited first.

**Exogenous Forces:** (a) the Prairie Market. The establishment of a few marginal operators can be directly related to the market conditions of the 1920's and 1930's. The following statement emphasizes the dependence of the mill operators on the prairie market:

Lumber exports to the United States have increased during recent years, but only a certain grade or type or class of Interior lumber can be sold to advantage in the said market. The preponderance of lumber produced in the Interior is of a low grade, which must be marketed in the western provinces.¹

Railway construction, oilfield requirements and public works constituted a portion of this market, but the purchasing power of the grain farmer continued to be the backbone of the prairie lumber demand. The relationship between the grain crop and the lumber trade is illustrated in Figure 18 by graphs of timber scaled in the North Central Interior and wheat exported from Canada, 1920-1940. The spending power of the farmers depends upon successful marketing of the grain crop. Consequently, a one-year lag in lumber purchases is evident. The successful grain crops of 1923 and 1928, for example, were not felt by the lumbermen until 1924 and 1929. Between 1920 and 1929 the rise and fall of wheat exports is reflected in the lumber production. In years of poor sales, several of the North

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Timber Scaled in the Northern Interior
and Bushels of Canadian Wheat exported

Central Interior mills were forced into bankruptcy.  

During the depression years, prairie agriculture maintained production at the expense of successive price declines. The two graphs in Figure 18 illustrate continued wheat export and a reduced timber scale between 1930 and 1938. By 1933 the price of wheat had been cut in half: farm incomes had decreased by an equal amount (see Table III.) Wheat prices rose again in 1937, but drought conditions, grasshoppers and rust combined to reduce the yield per acre to a low of 6.4 bushels. Consequently, the north central interior lumber industry, dependent upon the prairie market, remained at a low level throughout the 1930's.

The average value for spruce lumber from 1910 to 1962 for the province is indicated in Figure 19. The graph shows the declining price of lumber during the 1920's and 1930's. The low point was reached in 1934 at $15.45. The high lumber price of 1920 was not reached again until 1942. There was little incentive for technical improvement or expansion in the lumber industry of North Central British Columbia.

2. In 1917 Eagle Lake Sawmill went into receivership; in 1921 Shelley Sawmills declared bankruptcy. Both were substantial mills for the time. Western Lumberman, XIV (June, 1917), p. 32; and Western Lumberman, XVIII (April, 1921), p. 50.

3. Lumber prices for the North-Central Interior for these years are not available. Since a large part of the spruce lumber produced in the province comes from this area, the prices for spruce lumber have been graphed.
Table III: Effects of Depression and Drought Upon the Prairie Grain Trade, 1928 to 1939.

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield/Acre (bushels)</th>
<th>Domestic Wholesale Price*</th>
<th>Income Created by crops ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928</td>
<td>23.5</td>
<td>124</td>
<td>440.7</td>
</tr>
<tr>
<td>1929</td>
<td>11.5</td>
<td>124</td>
<td>323.6</td>
</tr>
<tr>
<td>1930</td>
<td>16.6</td>
<td>64</td>
<td>158.7</td>
</tr>
<tr>
<td>1931</td>
<td>11.8</td>
<td>50</td>
<td>92.1</td>
</tr>
<tr>
<td>1932</td>
<td>16.0</td>
<td>54</td>
<td>111.2</td>
</tr>
<tr>
<td>1933</td>
<td>10.4</td>
<td>68</td>
<td>109.0</td>
</tr>
<tr>
<td>1934</td>
<td>11.3</td>
<td>82</td>
<td>136.3</td>
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<tr>
<td>1935</td>
<td>11.3</td>
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<tr>
<td>1936</td>
<td>8.1</td>
<td>122</td>
<td>134.3</td>
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<tr>
<td>1937</td>
<td>6.4</td>
<td>131</td>
<td>130.6</td>
</tr>
<tr>
<td>1938</td>
<td>13.5</td>
<td>62</td>
<td>174.0</td>
</tr>
<tr>
<td>1939</td>
<td>19.1</td>
<td>76</td>
<td>212.9</td>
</tr>
</tbody>
</table>

*Price for Manitoba Hard at Ft. William.

Average F.O.B. Price for B.C.
Spruce Lumber, 1915-1962

Factors encouraging change in location: (a) Technological level. Limited demand, declining lumber prices and substantial market fluctuations resulted in the development of an undercapitalized, marginal type of industry. Most sawmills lacked the stability necessary for sizable capital investments in the machinery and equipment common to lumbering industries in other areas. Therefore, the level of technology severely restricted the areal spread of lumbering activity and limited the possible sites which could be selected by the sawmillers.

In the early years trees had been felled by axes and hand saws into the river and floated to the mills. As the timberline receded from the river-edge this method became impossible. The construction of temporary roads during the winter and the subsequent movement of logs by horse and sled to the mill or river-edge became the common method. The logging railway and steam donkey had been introduced to the southern parts of the province by 1915. Great tracts of timber had suddenly become accessible. By 1917 the southern interior operators were hauling logs 15 miles.\(^4\) Only companies with substantial capital backing, however, could afford the construction of such transportation lines. The sawmill operators in the North Central Interior did not have the financial resources necessary to replace horses with tractors or railway systems. In 1930 all the mills with the

exception of one were reported still bringing their logs from distances "well under two miles". Consequently, milling and logging operations were restricted to the area immediately adjacent to the Canadian National Railway.

(b) Raw Material Supply. In 1916 the *Western Lumberman* defined the motivation behind the establishment of sawmills in the North Central Interior:

...plants located before rail construction at points likely to become centres of development; others were started up by ranchers and land companies to supply a local demand for building material; but in most cases the impelling concerns were ideal mill sites going to waste, timber close at hand and assurance of transportation for output...  

The ideal mill site had three pre-requisites: an easily-accessible timber supply, a river for log transport and storage, and the rail line for distribution of the finished product. All three were found in the upper Fraser Valley.

It was the raw material supply that determined where the mills located. Figure 20 illustrates the areas of merchantable timber in the Fort George Forest District in 1937. Large continuous stands of timber are few: small patches of timber broken up by physiographic features common. The region with the largest timbered sections and the densest growth was located in the upper Fraser Valley.

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5. *British Columbia Lumberman, XIV, (June, 1930)*, p. 34.

Merchantable Timber in the Fort George Forest District as of 1937

Timber Over 10 M.B.M. per Acre
Timber Under 10 M.B.M. per Acre
Boundary of Forest District
Boundary Enclosing Fraser River Headwaters, Bowron River, and McGregor River Drainage Basins

Source: F.D. Mulholland, The Forest Resources of British Columbia, 1937, Dept of Lands, Victoria, B.C., p 115
Valley around Giscome, Hansard and Penny. The area outlined on the map, containing the drainage basins of the Bowron, Fraser River Headwaters and McGregor Rivers accounted for 60 per cent of the total accessible log scale in the district at that time. To this region came the sawmillers.

The mills located along the Fraser River in areas with maximum accessibility to timber stands. Since logging operations were areally restricted, only a fringe of the timbered area along the rivers and lakes could be considered accessible. Mills which located near to a supply of timber sufficient to support an operation cutting 60,000 board feet prospered and grew. Others, which happened to locate where timber stands were discontinuous in nature, were forced to abandon and relocate operations. Thus, the Eagle Lake Company was moved from the mouth of the Willow River to Giscome to take advantage of the greater timber shed.

The small size and number of early sawmilling ventures in the North Central Interior are directly related to the lack of a local demand and the fluctuating conditions of the prairie market. The low technological level of the industry, a factor resulting from the unstable market conditions, restricted sawmills to locations proximate to the Canadian National Railway. Within this limited area of economic exploitation, the location of prime timber

stands dictated the exact sites chosen by the entrepreneurs.

AREAL DISPERSION OF LOGGING AND MILLING OPERATIONS: 1940-1957

External forces which had a direct influence on the economic climate of the North-Central Interior after 1940 were: (a) a greatly increased demand for lumber, (b) war-time shortages of labour, equipment and capital, (c) high lumber prices, and (d) the lack of a positive forest management policy. These factors encouraged the development of a large number of logging/milling operations with low output and low productivity. Changes in transportation technology and the low wood recovery of mills were the factors which encouraged the movement of sawmills from railhead locations into timber cutting regions.

Exogenous Forces: (a) Increased Demand For Lumber. With the outbreak of the Second World War, Canada assumed the role of the principal Commonwealth supplier of raw materials. While the Coast shipped large structural timbers to Britain, the lumber industry of Interior British Columbia was called upon by the Federal Timber Control to supply a major part of Canada's domestic and war requirements. The demand from Canadian markets consisted primarily of war orders for the prairie provinces. Construction of army bases and air-training centres for the Canadian Air Force and the Commonwealth Air Training Scheme were projects requiring large quantities of common grade lumber. Conditions in British Columbia
were described as follows:

...it is the first time in history that every plant manufacturing every species of wood in every region of the country is operating at maximum capacity and can sell its product as soon as it is properly dried and ready for manufacturing.8

In the North-Central Interior, the lumber industry responded by expanding its productive capacity and moving outwards from the upper Fraser Valley into other timber areas. And still, "in Northern British Columbia ... American orders, Canadian orders and Canadian motor industry orders total far in excess of the capacity of the mills to load and ship..."9

A building boom in both Canada and the United States characterized the post war years. The United States, with a rapidly growing population and depleted forestry resources, was becoming more reliant upon external sources of lumber. By 1952 the United States accounted for nearly half of the total value of provincial forest products exported to foreign parts. The demand for lumber which was stimulated by the Second World War remained at a high level throughout the 1940's and 1950's.

This increased demand permitted the expansion and development of the industry in the North-Central Interior. Without it, the level


9. A.S. Nicholson, British Columbia Lumberman, XXVI, (September, 1942), p. 25. Mr. Nicholson was the Canadian Timber Controller during World War II.
of production and type of industrial pattern characteristic of the
1920's would have continued. This market increase necessitated an
areal expansion outwards to timber areas remote from the upper Fraser
Valley. The completion of the John Hart Highway north from Prince
George to the Peace River area and the Pacific Great Eastern Railway
south to Quesnel in the early 1950's provided access to these areas. 10
The demand, however, did not determine the type of industrial develop-
ment which occurred. A few large-scale firms could have dominated the
industry, rather than the multiplicity of small companies which
developed during the 1940's and 1950's. In the case of the former, a
very different structure and location pattern would have developed.
The increased demand acted as a permissive factor allowing the expansion
and development of the industry: a combination of war-time shortages,
high but unstable lumber prices and lack of government management
policy determined the type of industrial structure which emerged.

(b) Labour, Equipment and Capital Shortages: During the war
years, shortages of capital, labour and equipment were common. The
attraction of skilled labour to the shipyards and other war industries,
and the enlistment of men in the armed forces, had a marked effect on
sawmilling operations throughout the province. In 1942 it was

10. "Opening the Hart Highway a year ago has resulted in establish-
ing a number of sawmills. About 19 mills have started up in the Crooked
River Forest Resource, up the highway north of Summit Lake," British
reported in the *British Columbia Lumberman*:

In Northern British Columbia and Northern Alberta region production is somewhat below normal as a result of labour shortage, mainly caused by the movement of labour to government contracts in that vicinity.\(^{11}\)

By 1943 it was estimated that the provincial mills and camps were short 4,000 men; that the Interior lumber trade was operating at only 50 per cent capacity.\(^{12}\)

Compounding the problem of labour shortage was the difficulty involved in obtaining logging and milling equipment. During 1940 and 1941 the supply of equipment from the United States remained for the most part adequate. As the war needs demanded greater quantities of steel and rubber the supply became acute. By 1943 it was virtually impossible to obtain necessary machinery parts for repairs.\(^{13}\)

Productivity remained at a low level, while the demand for lumber far exceeded the capabilities of the industry. In turn, the capital necessary for investment was not readily available. The size of operations entering the lumber export industry remained severely limited.

In the immediate years after the war, equipment and capital

\(^{11}\) Nicholson, *op. cit.*, p. 25.

\(^{12}\) *British Columbia Lumberman*, XXVII, (May, 1943), p. 23.

were required by all phases of Canadian industry. Although the demand for lumber products remained high, capital for investment in the North Central Interior remained limited. Since little external capital was attracted to the area, investment remained small and localized in nature. It is probable that the instability of timber supplies and the fluctuating lumber prices created an insecure field for large-scale investment. The small companies which sprang up during the war continued through the 1950's.

(c) Lumber Prices. Between 1940 and 1950 lumber prices increased steadily (Figure 19). Fluctuations in the price of spruce lumber are reflected in the number of active sawmills of the region. In years of high prices, the number of operations increased significantly. In 1947-48, however, when prices dipped, the expansion of the industry was retarded (compare Figures 5 and 19). The levelling off of prices in 1951-52 was not reflected in the growth of sawmills until 1953. In general, the high level of lumber prices throughout this period encouraged the growth of the small producer.

(d) Forest Management Policies. By the 1940's the government had become aware of the need for conservation policies and fuller utilization of timber resources. Accordingly, the Royal Commission of 1945 was set up to inquire into the future of the forest industry. The resulting policy urged the establishment of sustained yield management of the industry, the aim of which was to provide a "perpetual yield of wood of commercially usable quality from regional
areas in yearly or periodic quantities of equal or increasing volume." A number of Forest Management Licences were issued through which the major companies were guaranteed sufficient supplies of timber for a long-term period. In return they agreed to administer the lands, providing fire control and reforestation. In other areas Public Working Circles were established and administered by the Forest Service. In these areas, no guarantees of timber supplies were made and sales went to the highest bidder.

In the Prince George Forest District only seven Forest Management Licences were granted, one near Quesnel and the remainder in the upper Fraser Valley. The rest of the area was reserved for establishment of public sustained yield units. Figure 21 illustrates the forest alienation in the Prince George Forest District by 1956. The established producers of the 1920's who were granted the licences were able to expand and plan long-term financing for their operations. Most of the operators, however, lacked this security of future timber supplies and their sales remained small and intermittent. By 1951, the Northern Interior Lumbermen's Association desired a second Commission to look into the governmental policies because of "the lack of confidence within the lumber


15. Since 1957 Public Working Circles have been known as Public Sustained Yield Units.
FOREST ALIENATION, 1956.
Forest Management Licences
(either awarded or reserved)

5-a Western Plywood (Cariboo) Co.Ltd.
5-b Church Sawmill Ltd.
7 Eagle Lake Sawmills, Ltd.
12 Penny Spruce Mills, Ltd.
13 Shelley Development, Ltd.
15 Sinclair Spruce Lumber Co.
16 Upper Fraser Spruce Mills, Ltd.

Public Sustained Yield Units

2 Babine
2b Big Valley
4 Bowron
5 Carp Lake
8 Logworth
8b Cottonwood
9 Crooked River
10 Parsnip
11 Stum Lake
15 Narcosti
16 Naver
19 Quesnel Lake
27 Smithers
29 Stuart Lake
31 Westlake
32 Williams Lake
33 Willow River

Figure 21
industry in the present policies and their interpretation." In the inquiry of 1956, one of the themes was criticism of the Public Sustained Yield Unit. As Mr. Walter Koerner stated:

The conversion plant using logs from a sustained yield unit has not assurance of a continuous supply of raw materials. Therefore, the tendency for plants dependent upon such logs must be to limit their investment. Conversion plants with a limited assured supply of wood and a low capital investment do not in general produce a high priced or readily marketable product. They cannot afford research for new developments and better wood utilization. In addition, neither they nor the logging operations are under any compulsion to operate continuously in times of poor markets. They can more readily afford to shut down as their depreciation and overhead are low.

This statement described the state of the lumber industry in Interior British Columbia. The lack of a stabilized timber supply was not new. In 1943 examples had been cited of companies setting up operations in timbered areas only to find other sawmills moving in and rapidly depleting the resources. A plea for a better designed forest policy with protection for the established operator had been made. Two years later in 1945 Chief Justice Sloan in the Commission had stated:

The Interior Lumber Manufacturers Association has recommended for the Interior that "all existing operations should be brought under licence and no new operation should be licenced until the availability of timber in the area affected, sufficient to guarantee the maintenance of that operation on a sustained-yield basis in perpetuity has been determined."

In my opinion this recommendation should be implemented. It is a much better policy to plan and manage any Interior sustained yield unit so that one mill may be assured of continuity of supply and permanent operation than to allow the productive capacity of an area to be divided between four or five mills with the result that none of them has a sufficient supply to ensure an economic production, thus leading to the ultimate disappearance of them all.

Ghost towns in the Interior bear distressing and silent witness to the past policy of too many mills cutting out areas that could have supported in perpetuity, on a system of planned management, the potential capacity of probably half of them.19

Such a system of licencing, if it had been implemented, would have produced a different industrial structure. Instead, a method of restricting entry into the industry, and of guaranteeing already invested capital was not introduced until 1961.

With the advent of the Sustained Yield Unit in 1945, a restriction in the allowable cut of forested areas came into effect. Established operations had limits placed upon them. If six companies were operating on an allowable cut of 24,000,000 board feet, for example, each on the average could expect to use 4,000,000 feet annually. If, however, three additional mills entered the area, the cut of each was reduced. During the 1940's and 1950's the system of auctioning timber offered no guarantee to the original six sawmill operators that they could obtain additional blocks of contiguous

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timber stands. Timber was acquired by the highest bidder. And in some cases speculative bidding carried the price far above the profit margin of the established operator.

The forest management policies helped to perpetuate the large number of undercapitalized producers. In the Public Inquiry of 1956 evidence was heard to indicate that capital investments in the lumber industry of the North Central Interior were given little security. Hans Roine of Clearlake Sawmills Ltd. whose investment at this time totalled $110,000 stated that his timber supply was guaranteed for only 18 months in advance. In addition he made the following comment:

I feel that being an established operator in an area should carry some certain protection. ...we have realized for some long time that we must come to a greater utilization of forest products which we are totally unable to do today if we are only going to know within one or two years as to what period of time we can remain in operation. 20

Large-scale operations were not encouraged in their development, nor attracted to the area. Some of the operators in the sustained yield units set up voluntary associations to control the distribution of the allowable cut. In the Prince George area four such associations were set up in the Crooked River, Westlake, Willow River and Naver Sustained Yield Units. 21 For the majority of sawmilling companies, however, continued operation remained guaranteed on a short term

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21. Ibid., p. 7615.
basis only.

The increased demand of the war needs of the 1940's and the building boom of the 1950's necessitated the rapid expansion of both lumber production and number of active sawmills. The resulting structure was that of a number of marginal and often seasonal producers. It was an industrially immature region in which sawmills operated on an ad hoc basis and few entrepreneurs had a developed business sense. The minimal barriers to entry into the industry encouraged a large number of mills to operate intermittently; namely in times of high lumber prices, readily accessible timber supplies and dry weather. When physical or economic conditions became less than "ideal", a large number of these small marginal operations closed. The north central interior industry of the 1940's can in many ways be compared to the coastal industry of the 1920's. At that time a large number of small companies were cutting timber up and down the coast, most of whom vanished during the depression of 1929.

The dispersed location pattern which characterized the North Central Interior at this time partially reflected the type of market open to the entrepreneur. The mill operators could sell one product only, lumber. Any wood not suitable for the manufacture of lumber was left behind or burned. This single product market, combined with the type of sawing equipment common in the region, created an industry in which the lumber recovery was particularly low.
As timber cutting moved away from the established milling areas, it became uneconomical to transport the logs when perhaps only 50 per cent of each log would eventually be cut as lumber. This situation, plus the application of new forms of transport media, encouraged the relocation of mills within cutting areas.

**Factors encouraging change in location:** (a) **Lumber recovery.**

In 1956 a study was carried out on 12 mills in the Prince George area to determine the amount of sawmill residue resulting from the methods of manufacturing lumber. Five of the mills were cutting more than 20 M. bd. ft.; seven cutting less than 20 M. bd. ft. The results were as follows:

**Table IV: Percentage of Residue**

<table>
<thead>
<tr>
<th>Mills cutting more than 20 M. ft. b.m. / 8 hrs.</th>
<th>Volume of Solid Residue</th>
<th>Volume of Sawdust</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.8</td>
<td>18.7</td>
<td>39.5</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Mills cutting less than 20 M. ft. b.m. / 8 hrs.</th>
<th>Volume of Solid Residue</th>
<th>Volume of Sawdust</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.0</td>
<td>17.9</td>
<td>40.9</td>
<td></td>
</tr>
</tbody>
</table>

On the average, about 40 per cent of each green log was classified as

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sawmill residue and 60 per cent was converted into lumber. Variations could be found throughout the area with the large stationary mills having a higher recovery, and the small portable mills with less efficient equipment producing at a lower level. And secondly, the recovery factor varies with the diameter of the log. The lumber recovered from a 6-inch log is only 72 per cent of that recovered from a 20-inch log. In some of the stands of timber to the west of Prince George and in the Dry Belt to the south the recovery easily averaged less than 50 per cent.

(b) Changes in Transportation Technology. The single factor which permitted the movement of the sawmill into the timber-cutting regions was the introduction of truck logging. Since equipment and fuels were difficult to obtain during the war, horses were used extensively for logging until about 1945. A change to crawler tractors, arch-trucks and lumber trucks characterized the post-war years.

The under-financing of the industry and the low wood recovery discouraged the use of logging trucks and loading equipment. It was the lumber truck that revolutionized the region. The initial capital outlay for a lumber truck is considerably less than that for a logging truck. In addition the movement of rough lumber is less expensive than the transportation of logs. The sawmiller pays $11.00 - $12.00 per M. bd. ft. to transport logs 40 miles, as compared to $4.50 - $5.00
per M. bd. ft. for rough, cut lumber. To justify the building of a centralized conversion plant and the moving of logs 40 miles, an additional $7.00 per M. bd. ft. has to be gained. Today, the high lumber recovery and the advantages of large-scale, centralized operations have more than offset the cost of log transportation. This was not the case in 1950. The transportation savings realized from the reduced volume and weight of rough lumber dictated the location of the sawmill at the timber-cutting site.

A second change occurred in the movement of logs from the stump to the mill. Tractor skidding replaced the horse for this operation, but the skidding distance was still restricted to two miles. In 1955, the introduction of the arch-truck extended this distance 10 miles. The arch-truck was designed to transport logs in tree-lengths from the landing to the mill by hoisting the load at the front and allowing the tree ends to drag behind. The investment necessary in an arch-truck was considerably less than that needed for a truck and trailer. In addition, the cost of a two-mile haul by arch-truck was $2.00/M. bd. ft. as compared to $3.75 for truck, trailer and loader. The combination of arch-truck and lumber truck proved to be the most


economical, as well as most flexible, for the small operator with limited capital available for investment. By extending the supply area of the mill from two to 10 miles, the arch-truck encouraged the continuation of the resource-oriented conversion unit.

FUNCTIONAL INTEGRATION AND AREAL CONCENTRATION OF CONVERSION PLANTS: 1958-1966

Consolidation of the lumber industry into fewer large-scale units, and the subsequent areal concentration of the units have been two trends characterizing the industry since 1958. Three exogenous forces appear to have been influential: (a) market demands, (b) labour demands, and (c) changes in the provincial forest management policy. To cope with conditions brought about by these factors, entrepreneurs have been forced to increase capital investment in specialized equipment, to develop larger-sized conversion plants and to integrate as many functions as possible. In turn, fuller utilization of wood products has lessened the traditional tie to raw material sources. Factors encouraging the shift of conversion plants to centralized railhead locations are: (a) higher wood recovery, (b) year-round operation, (c) accessibility to timber supplies, (d) labour stability and (e) control of the marketing and shipping functions. The three exogenous factors and the entrepreneurs responses will be examined first.

Exogenous forces: (a) Market Demands, Growing markets for
wood products other than lumber as well as demands for a standardized higher grade of lumber product have had a pronounced effect on the forest industry. Since the United States is British Columbia's largest customer of forest products, the changing trend in product quality and mix dictated by this market is reflected in the adaptation of the provincial industry. The following figures indicate the probable total consumption pattern of forest products in the United States for the years 1950, 1960, 1980 and 2000.

Table V: Consumption Patterns of Forest Products in the United States

<table>
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<tbody>
<tr>
<td>Lumber (billion bd. ft.)</td>
<td>42</td>
<td>37</td>
<td>33</td>
<td>31</td>
</tr>
<tr>
<td>Plywood and Veneer (billion s.f. 3/8&quot;)</td>
<td>3</td>
<td>8</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Pulp (Millions short tons)</td>
<td>17</td>
<td>27</td>
<td>47</td>
<td>76</td>
</tr>
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</table>

The study indicates that a decline in the relative place of lumber versus plywood has taken place and also, that substitutes are taking over some of the functions of wood, particularly in the structural uses.

26. Eighty-five per cent of provincial lumber exports and 89 per cent of newsprint exports are marketed in the United States.

The fourfold increase in the volume of pulp required is emphasized. It is this growing demand for wood products other than lumber that has been felt in the North Central Interior. Since 1950 three veneer and/or plywood mills have begun operation, with three more in the planning stages. In addition, six pulp mills have recently opened, or are under construction in the region.

Secondly, the lumber producers have been faced with market demands for a higher quality product. To compete with other lumber producers, the sawmillers have had to standardize their lumber grading system and invest in additional equipment. Where previously it was possible to ship rough, green lumber, it has now become mandatory to export dressed and dried lumber. Drying is accomplished either by air drying for a number of weeks or by kiln drying\(^{28}\) in a matter of days. Either method necessitates the investment of capital; the former in large lumber inventories, and the latter in actual equipment. In addition to buyer demands, the transportation savings gained from the reduced weight act as incentives for the installation of drying facilities.\(^{29}\) The demand of European markets for packaged lumber is

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\(^{28}\) Drying lumber in a kiln is accomplished by means of gas fired burners and high temperatures. The drying time varies with the thickness of the lumber. A rule of thumb used is a day of drying for each quarter inch of lumber.

\(^{29}\) The rail rates for lumber shipments are based on specified weights. If the shipper's weight for a carload of lumber is under the specified weight he saves money. If the carload exceeds the specified weight he pays extra for the transportation.
also being felt by the sawmillers. The packaging is accomplished by strapping and wrapping dried lumber in water resistant kraft paper or polyethylene as protection against moisture and dirt. Again, additional expenditure in equipment and labour is necessary to market lumber in this form. A small under-capitalized sawmill is unable to meet these demands.

(b) **Labour Demands:** Labour demands have forced the higher capitalization of the average conversion unit. In 1953 the basic rate for common labor in the North Central Interior was $1.35 1/2 per hour, for a Gang Mill Sawyer $1.95 1/2 per hour. By December 1, 1966, the basic hourly wage of a labourer had risen to $2.26, while the Gang Mill Sawyer earned $2.86 and Sawyers on automatic carriages more than $3.00 an hour (see Figure 22). Employees also gained benefits of additional paid statutory holidays and vacations, national pension plans and increased workmen's compensation benefits. However, during that same thirteen-year period the market price for dressed lumber did not increase at the same rate. As Figure 22 illustrates, the value for spruce lumber in 1953 was $54.93/M. bd. ft.; in 1960 it sold for $50.95; and in 1965, the value increased to $59.97. Between 1953


32. The wages indicated in Figure 22 refer directly to those paid in the North Central Interior. Higher wage levels existed on the Coast and in the Southern Interior.
Figure 22

Average Value of Interior Spruce Lumber and Basic Hourly Wage in North-central British Columbia, 1950-1966

SOURCES:
2. D.B.S. Mimeographed Tables (unpublished)
and 1965 wages increased by 80 per cent and lumber prices by 10 per cent. The entrepreneurs were caught in the familiar predicament of having to increase labour productivity to maintain fair returns on their investments.

To hold costs in line, management has reduced the relative importance of the labour input. The introduction of equipment such as automatic debarkers, linebar resaws, shadow-line trimmers and automatic lumber stackers has cut the manpower needed. In the Jacobson operation in Williams Lake, 20 men produced 23,000 feet of lumber per shift in 1950; in 1966 that same number of employees produced 90,000 feet per shift. The use of automated equipment in a well-designed plant has permitted a continuous flow through the mill. Consequently, each piece of machinery and hour of labour achieves its full potential. From log entry to finished lumber, the economy in manpower has moved to a level where there is little likelihood of further improvement.

(c) Provincial Forest Management Policies: Two aspects of the provincial forest policy appear to be influencing the forest industry: (1) timber supply stabilization and (2) the introduction of a close utilization policy. Although the concept of sustained

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34. Statement by Mr. G. Caine, personal interview, March, 1966. The one area in the sawmilling process that remains to be automated is the sorting of lumber.
yield came into effect in 1945, no guarantee of future timber supplies for established operators existed. In 1961, timber supply stabilization was introduced. Firstly, an inventory of the sustained yield units was taken and allocation of annual allowable cut made to the established operators on the basis of their previous three year's performance. Secondly, bidding practices were changed so that operators who requested the timber sales put up for auction were permitted to meet the highest bid. The completion of the quota allocation and the altering of the bidding system effectively closed the lumber industry in established areas to new companies. These policies permitted larger capital investments in individual operations and encouraged the corporate consolidation of the industry. The only avenue open for individual expansion now is the purchase of other quota holders. Table VI illustrates the changes which occurred in the number of quota holders in sustained yield units between 1961 and 1966. Figure 23, Forest Alienation 1964, locates the units listed in Table VI. In nearly every case, the number of quota holders has decreased substantially. In the Moberly Public Sustained Yield Unit, the number decreased from 24 to 2 in the five-year period.

The second management policy influencing the industry is the promotion of full utilization of forest resources. A close utilization policy which not only provides the basis for the substantial pulp mill development in the region, but also influences wood utilization throughout the industry, has been developed. The policy is aimed at
Forest Alienation, 1964.

Forest Management Licences (either awarded or reserved)
1. Eagle Lake Sawmills, Ltd.
2. Church Sawmills, Ltd.
5. Western Plywood, Co., Ltd.
28. Shelley Development, Ltd.
29. Eagle Lake Sawmills, Ltd.
30. Sinclair Spruce Lumber Co., Ltd.
31. Upper Fraser Spruce Mills, Ltd.
34. Church Sawmills, Ltd.

Public Sustained - Yield Units

4. Babine
10. Big Valley
11. Blueberry
13. Bowron
15. Burns Lake
18. Carp
44. Nechako
50. Ootsa
51. Parsnip
52. Peace
53. Purden
55. Quesnell Lake
59. Robson
69. Smiers
72. Stuart Lake
73. Stum
74. Takla
78. Westlake
80. Williams Lake
81. Willow River

Other Public Units - S.S.A. Special Sale Area

<table>
<thead>
<tr>
<th>Sustained Yield Unit</th>
<th>Annual Quota</th>
<th>No. of Licencees</th>
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<tr>
<td></td>
<td>M/cu. ft. (as of 1966)</td>
<td>1961</td>
</tr>
<tr>
<td>Big Valley, No. 1</td>
<td>3,000</td>
<td>3</td>
</tr>
<tr>
<td>Big Valley, No. 2</td>
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<td>5</td>
</tr>
<tr>
<td>Blueberry</td>
<td>4,283</td>
<td>5</td>
</tr>
<tr>
<td>Bowron, No. 1</td>
<td>4,300</td>
<td>1</td>
</tr>
<tr>
<td>Bowron, No. 2</td>
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<td>3</td>
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<td>Canoe</td>
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<td>3</td>
</tr>
<tr>
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</tr>
<tr>
<td>Carp, No. 2</td>
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<td>3</td>
</tr>
<tr>
<td>Carp, No. 3</td>
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<td>Cottonwood</td>
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<td>Naver, No. 1</td>
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<td>Naver, No. 3</td>
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<tr>
<td>Nechako (a new unit)</td>
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<tr>
<td>Parsnip</td>
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<td>15</td>
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<td>Purden Lake</td>
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<td>Robson</td>
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<td>Stuart Lake</td>
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<td>10</td>
</tr>
<tr>
<td>Willow River</td>
<td>7,000</td>
<td>24</td>
</tr>
</tbody>
</table>

¹ Priority system of allocation of volume (quota) has not been established pending completion of removal of timber below proposed Mica Creek Dam floodline.

* Annual quota has increased since 1961.

increasing wood recovery by using small logs and logging residue previously left behind in the woods. Its success depends upon the establishment of pulp mills and the extension of established logging and sawmilling operators into smallwood utilization and chip production. To achieve these ends, the government has introduced new forms of tenure, modified stumpage rate schedules, altered freight rates and enforced new standards of utilization.

To encourage the establishment of a pulp mill economy, the Provincial Government introduced the pulpwood harvesting area. The harvesting areas are confined to public areas which are established as public sustained yield units and administered by the Forest Service. Pulpwood Harvesting Area #3, for example, comprises the Bowron, Longworth, Monkman, Purden and Robson Public Sustained Yield Units. The licencee of the harvesting area is entitled only to the wood unsuitable for sawmilling. Saw and peeler grade logs are reserved for saw and plywood mills. The five pulpwood harvesting areas which have been granted in the North-Central Interior are shown on Figure 24. The establishment of these harvesting areas has super-imposed a pulp economy upon an existing sawmill economy and yet provided every phase of the industry with its raw material needs.

A second aspect of the close utilization policy is its effect on the sawmilling industry. On January 1, 1966, the full program of the government's policy came into effect. The new program calls for the calculation of allowable cuts to a 7" diameter as compared to an

PHA 1 Awarded to Prince George Pulp and Paper Co., Ltd., covers Big Valley, Corp, Crooked River, Nover, Nechako, Parsnip, Stuart Lake, Westlake and Willow River Public Sustained-Yield Units.

PHA 3 Awarded to Northwood Pulp Co., Ltd., covers Bowron, Longworth, Monkman, Purden, and Robson Public Sustained-Yield Units.

PHA 4 Awarded to Bulkley Valley Pulp and Timber Co., Ltd., covers Babine, Longworth, Monkman, Purden, and Robson Public Sustained-Yield Units.

PHA 5 Awarded to Cariboo Pulp and Paper, Ltd., covers Narcosli, Cottonwood, part of Stum, and Quesnel Lake Public Sustained-Yield Units and part of an unregulated area.

PHA 7 Awarded to Intercontinental Pulp, Co., Ltd., covers Peace and Tokla Public Sustained-Yield Units.

Source: British Columbia Forest Service, Department of Lands, Forest and Water Resources.
old standard of 11" diameters. The operators must now cut and log these logs with diameters between 7 and 11 inches that were previously left behind. Scaling practices have also been changed and trees previously considered of little economic value must now be logged. The sawmiller must now handle not only a greater volume of logs, but also smaller diameter logs. This requires a capital outlay in additional equipment.

The market demands, labour demands and changes in forest management policies have necessitated increased capital investment in the forest industry of the North-Central Interior. To meet these demands, and to achieve the greatest returns possible on investments, the industry has made several responses: (1) consolidation of the producing units, (2) integration within the industry and (3) specialization of functions.

The market demands for a more standardized and higher quality lumber product has meant changes primarily in the planing, drying and shipping operations rather than in the initial sawing stages. The introduction of a new market for pulpwood chips has for the first time permitted the larger operations to sell a portion of their waste products. The bush sawmill, unable to add the necessary equipment for the manufacture of high grade lumber products and pulpwood chips have

gradually had their sawmilling function absorbed by the large-scale integrated sawing/planing plants. The small entrepreneur of the 1950 era has been forced into a non-competitive position.

Secondly, rising labour costs in a milieu of stable prices have necessitated increased labour productivity for the survival of sawmill operations. Two basic techniques used to achieve this end have been: (a) larger-scale of operation, and (b) the use of automated equipment. The size of mills has in part been dictated by the production rate of the saw machinery. The minimum size of sawmill, for example, that can amortize the investment in a barker and chipper is one producing 10 to 15 million feet of lumber annually. The investment in these large pieces of heavy machinery dictates a permanent rather than portable mill. Consequently, the sawmill operators have had to re-assess their choices for the location of lumber production.

The capital outlay required for pieces of equipment such as planing facilities, smallwood equipment or chipping and barking machinery can only be justified as a long-term investment. The stabilization of timber supplies has permitted borrowing and long-term planning within the industry. If no future guarantee of continued operation had been made, it is unlikely that the industry could have

36. Statements by Mr. C. Pinette, Mr. M. Rustad and Mr. G. Caine indicate that the minimum size of mill that can install a barker and chipper is one producing 10 to 15 million feet of lumber annually. Personal interviews, March, 1966.
met the market and labour demands.

With long-term planning a possibility, the integration of wood conversion from cutting through sawmilling, drying, planing, packaging and sometimes remote warehousing is a logical method of achieving even greater economies. Savings result from greater management control over existing capital investment, and from an improved product flow from start to finish. These same economies are sought by the pulp mills by the integration of all manufacturing processes.

Forest management policy and again economies of production are leading to greater specialization in the industry. The introduction of smallwood utilization is encouraging the growth of permanent mills which process small diameter logs. These stud or scrag mills, as they are called, usually mass-produce a single dimension of lumber. The cutting of either smallwood or large timbers requires equipment which becomes uneconomical if large volumes of suitable timber are not available. The new "chip-n-saw" machine, for example, handles only a 14-inch diameter of log or less. Forest management policy has enforced full utilization of resources by all conversion plants. Mills that are too small to install facilities for the manufacture of waste material are being forced to close. At the same time, utilization standards are encouraging the integration of larger units so that the

per cent wastage can be lowered in all manufacturing phases. The net structural effect of all three factors has been to create a lumber industry in which a smaller number of operators are producing a greater volume and diversity of lumber products, as well as saleable waste products.

**Factors encouraging changes in location. (a) lumber recovery.**

The areal concentration of conversion units summarizes these structural changes. Full utilization, necessitated by both forest management policies and market demands, has meant that each log transported from the woods contains a decreasing proportion of waste material. This factor has reduced the relative importance of log transportation costs. With the lumber recovery factor at 50-60 per cent during the 1950's, it was economically unfeasible to move logs. In 1966, eighty per cent or more of the log can be recovered in saleable products and the additional cost incurred by log transport can be offset. The introduction of the heavy duty diesel logging truck is a second factor permitting the long distance movement of logs. The gas trucks of the early 1950's had prohibited long distance hauling. The combined effect of the higher wood recovery and transportation technology changes has been an increase in the maximum hauling distance from 15 miles in 1954 to a

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38. See Chapter IV, p.101 for cost differences existing between transportation of lumber as compared to logs.
100-mile distance in 1966. This increase has permitted the introduction of centralized conversion plants at railhead locations.

(b) Year-round operations. To keep the per unit cost of production as low as possible, the conversion plants of 1966 must operate on a year-round basis. Locating the mill in an area with various services such as fire protection or repair services close at hand, lessens the probability of a prolonged closure. The seasonal nature of roads in the North Central Interior is a second factor. The flow of lumber from an integrated operation located in the "bush" is directly affected by "break-up" in the spring and "freeze-up" in the fall. A centralized mill with an inventory of logs is not directly affected by the seasonality of trucking services.

(c) Accessibility to timber supplies. A plant located in a centralized position permits access to a wide range of forest resources. This is particularly important for specialized operations such as plywood or stud mills which use only a small per cent of any given timber stand. The mill can receive logs from a number of scattered stands rather than from a single source. In addition, the logs can be sorted and directed to the appropriate manufacturing process. Consequently, the Weldwood plywood plant in Quesnel draws its log

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39. Estimates given as to the "maximum economic distances logs could be hauled" varied from 60 to 120 miles. The farthest distance logs are being transported known by the author is 100 miles. More common maximum distances are 75 miles.
supply from six different public sustained yield units.

(d) Labour Stability and accommodation. Labour stability is an important factor favouring urban locations for plants. The mill of the 1950's required neither a large nor skilled labour force. For efficient operation the highly capitalized sawmill, plywood plant and pulp mill of the 1960's need large pools of skilled labour. It has become impossible to engage and retain skilled men in operations remote from urban centres. A more stable and dependable labour force results when employees can live at home with their families and enjoy the benefits of an urban life. In addition to coping with labour problems, entrepreneurs of outlying mills must provide room and board facilities for their employees. The cost of operating a cookhouse and bunkhouses has been estimated at $1.00 per M. bd. ft. of lumber cut. An urban location eliminates these extra costs.

(e) Marketing and shipping. Finally, factors favouring centralized locations are benefits realized from the marketing and shipping of products. A railhead location provides access to a wider market for waste products, namely pulpwood chips, sawdust and

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40 Statement by Mr. H. Jacobson, personal interview, March, 1966.

41 Statement by Mr. C. Pinette, personal interview, March, 1966.
If a conversion plant is not on the rail line or within a few miles of a pulp mill, it is unlikely that chips could be sold profitably. In addition, the entrepreneur is able to keep in much closer contact with wholesalers and is able to fill orders more rapidly from a more accessible location. In view of the competitive nature of the industry today, this contact is looked upon as a critical factor.

The higher recovery of saleable wood products and changes in transportation technology, together with the need for a year-round operation and a stable labour force offer explanations for the growing areal centralization of conversion plants in the North Central Interior. Lesser economies realized by the mills from not providing housing facilities, from gaining access to a wide range of raw materials and from using ancillary amenities of urban centres (such as electricity, fire protection, machinery repair services and tradesmen in related occupations) have also influenced the entrepreneurs' decision to relocate operations. It is suggested that the influence of these variables will increase in strength and result in further areal concentration of conversion units.

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42. It is probable that some of the pulp mills will be purchasing hog fuel from the sawmills in the future. Hog fuel is waste material unfit for pulp manufacture. It contains bark as well as wood waste and is used primarily as a fuel.

CHAPTER V

SUMMARY AND CONCLUSIONS

Peripherally located raw material supply areas respond to external forces such as market demands, capital supply and changing economic conditions. These are not uniform forces, but vary over time. Their total effect is to change not only the relationship of the supply region to other producing and consuming regions, but to initiate a gradual evolution of spatial and corporate rationalization within the supply region itself.

As general economic conditions change, a resource industry adjusts until a new equilibrium is attained. In the forest industry, the raw materials, the basic manufacturing processes and the products have remained virtually unchanged. Adjustments in the structure and location of the industry have resulted from changing forest product supply and demand conditions, and from changing economic conditions within the region. By following the North Central Interior through its four basic periods of development, it has been possible to illustrate a particular series of demand changes and adjustments within an industry-region.

Before 1900, the world demand for lumber was not sufficient to stimulate the development of a forest industry in a remote area like North Central British Columbia. The timber supplies of the North Western States, of coastal British Columbia and of the Southern Interior of the province were adequate to meet current demands.
Settlement of the prairie provinces and the apparent end of alternate supplies of timber changed this situation and resulted in the establishment of speculative claims on forest land, together with the building of a few conversion plants in prime timber areas along the new railway route. The demand for timber products from the region abruptly halted with the outbreak of World War I, however, and the North Central Interior was left relatively unchanged.

The supply and demand conditions did not change significantly during the 1920's and 1930's. The world economy stagnated and major investments of all kinds were halted. The productive capacity of the region and abundant resources were under-utilized because of the depressed world demand and alternate supplies in other timber areas. Irregular plant operation, no speculative cutting, no technological improvements and restriction of the areal spread of operations constituted the adjustment of the region to these conditions.

The second world war and the post war years were characterized by a demand for lumber greatly in excess of the world productive capacity. This change in demand, coupled with insufficient investment capital, labour and equipment for the development of large-scale operations, resulted in the rapid expansion of a large number of small, seasonal producers into all accessible parts of the North Central Interior.

An increasing but diversifying demand, the enforcement of
specific management policies for the utilization of forest resources, and competitive marketing conditions are external forces characterizing the 1960's. Rising labour costs and the availability of capital for investment have again changed the economic conditions within the region. The adaptations of the industry have been corporate integration, the development of large-scale production units, the diversification of production and the areal centralization of conversion units.

The evolution of the forest industry in North Central Interior British Columbia demonstrates several basic principles of development and location. The trend in recent years has been for industries to be less seriously affected in their location by the location of their raw materials. The forest industry-region discussed in this thesis, however, has been typical of resource industries engaged in the initial extraction and processing of products in which the raw material procurement costs have remained critical locating factors. That the forest industry (and other resource industries in which the materials lose considerable weight and/or bulk during manufacturing) is attracted to the site of its raw materials was established at the outset of this examination. Two further generalizations can now be made concerning the type of development and spatial pattern which characterize the resource industries located in raw material supply or resource regions.

A distinction must first be made between a resource industry located in a region of balanced economic growth and a resource industry located in a resource region. In the case of the former the market and
the supply region may be the same area; while in the case of the latter the supply and market regions are distinct entities. It is evident from this study that the demand factors for a resource product which originate within the resource region are not important in determining the development of that resource. In all such cases the demand area is significantly larger than the supply area so that national or world aggregate demand looms important. The development of the industry is, therefore, determined by general economic conditions and the world supply and demand situation for the product, and not by regional or local forces. This principle has conditioned the development of many resource industries, in particular those connected with the mines, farms and forests. Thus, in the North Central Interior the local conditions have been influenced by provincial and national developments, which have in turn resulted from world economic forces.

Secondly, a resource region responds to these external forces at a given level of demand at a given price. The level of economic development within a region is determined by the capability of resource and factory management to adapt their processes and products so that they can compete at the prevailing price level. All factors of technological improvement, corporate adaptations, maximum raw material utilization and the development of investment-generating forest management policies in the 1960's led to a situation in which the North Central Interior could compete. The timing of changes in price and demand, coupled with the changing economic environment of the
region, determine the time at which changes in industrial location occur. The spatial pattern is, therefore, a dependent variable, reflecting the entrepreneur's concept of best coping with changing supply and demand situations.

Future adjustments in both the structure and location of the forest industry in North Central Interior British Columbia can be expected. It is anticipated that the economic demands presently influencing the industry will not change in the immediate future, but that the rationalization of producers and manufacturing processes will continue until a new equilibrium is attained. At this point the industry will be highly centralized into a few conversion centres, integrated to a significantly greater degree, and dominated by a few large corporations.
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