THE RUDE SCIENCE: A SOCIAL HISTORY OF WEST COAST LOGGING, 1890-1930

by

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ABSTRACT

During the late nineteenth and early twentieth centuries the logging industry of the Douglas Fir region of coastal Washington and Oregon underwent a structural, technological and managerial transformation. Vast tracts of timber were acquired by timber capitalists who moved their operations westward from the denuded forest lands of the east and midwest, and the adoption of railroad technology for the final stage of log transportation contributed to an expansion in the scale of logging operations. Confronted by a particularly unstable productive setting, intense competition and uncertain markets, logging operators engaged in a concerted effort to reduce operating costs and secure a more rigid control over the production process.

This study examines two related aspects of the search for efficiency: the development of increasingly sophisticated harvesting technologies; and the inception and moulding of degree programs in logging engineering at western universities. Technological innovation involved the displacement of animal-powered logging by the steam engine during the late nineteenth century, followed by the adoption of overhead systems of logging in the early years of the twentieth century. The state played a crucial role in the reorganization of the production process. When the acquisition of huge areas of timberland and the transition to large-scale production coincided to produce a managerial crisis, operators responded by forging an alliance with university educators and administrators in the establishment of instruction in logging engineering within the forestry schools of those universities.

This historical process is examined from current perspectives in labour process research. It is argued here that technological and managerial innovations resulted not only in significant gains in productivity, but in an erosion of the control that loggers exerted over the crucial yarding procedure. Many of the skills which had been of central importance in earlier methods of harvesting the resource were made redundant by the implementation of aerial or overhead methods of logging. The discretionary content and task range of occupations on the yarding crew were progressively narrowed. Similarly, the duties performed by the logging engineers brought a new level of managerial control to coastal logging, enabling operators and managers to regain administrative authority over operations. Although the relationship between educators and operators was often marked by tension over the nature of programs, the universities served to reinforce capitalist control over the workplace. Relations between the engineers and their employers were characterized by a similar conflict over the degree of autonomy engineers would possess in the determination of policies. This conflict did not detract from the engineers' function in the labour process: to facilitate the concentration of planning and design work within a managerial elite.

In the context of labour process theory, this study demonstrates the continued relevance of Harry Braverman's "degradation of work" thesis. The resistance of loggers to dangerous and oppressive technologies had no discernable influence in forestalling changes in productive

techniques, although worker resistance did effect changes in features of the employment relationship which were peripheral to the production process. Still, the important theoretical and methodological considerations raised by Braverman's detractors are upheld. Developments in technology and the division of labour undermined the loggers' relationship to the entire production process, but the unstable environment of coastal terrain and timber denied operators the factory-like productive setting they desired. Loggers continued to possess considerable autonomy at the workplace, and their conceptual and physical skills remained of paramount importance in logging operations at the end of the period under study.

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DEDICATION

To My Mother, and to the Memory of My Father

INTRODUCTION

This study attempts to explain how and why the experience of working in the logging industry of coastal Washington and Oregon changed between 1885 and 1930. During this period the production process of the industry was transformed from one that involved animal power and was largely controlled by the work of skilled loggers, to one that involved huge machinery and complex harvesting systems. Although a logging operation in 1930 was still dependent upon the skills of the loggers involved, the process of technological and managerial change had eroded much of the control loggers had exerted over both the conduct of operations and the pace of production.

It is hoped that this investigation will contribute to an improved understanding of the lumber industry and its workers in particular, and the social history of the coastal region in general. Given the fact that the economic well-being of thousands of workers, their families and communities have been dependent upon the success of the region's lumber capitalists in selling their products in competitive national and international markets, it is perhaps understandable that companies and industry leaders have received more attention than workers. The most prominent works of a scholarly nature concerning the industry are company histories, biographies of prominent lumbermen and studies of the lumber trade.[1] When scholars have focused their attention on the industry's workers, the emphasis has been on overt industrial conflict and unionization.[2] The subject of work itself has, in the main, been left to popular historians who have produced a number of illustrated books which convey a romanticized conception of work in the western woods.[3] One of the purposes of this study into the changing nature of work in the industry is to go beneath the stereotypical depiction of big men wrestling with giant timber; to see logging operators and loggers as participants in a mass production industry which generated pressures common to such industries in a capitalist economy.

During the period under study, intense interregional and intraregional competition, unstable markets and fluctuating profit margins encouraged the owners of these concerns to engage in a concerted effort to minimize production costs and exert a more rigid control over the conduct of their operations. This activity came under the general heading of a search for "efficiency" which involved two related areas of pursuit. The most important, from the perspective of the workers, was the development and implementation of new power sources and systems of logging. A second involved the creation of logging engineering programs at western universities and the placement of this cadre of middle managers throughout the industry. The state played a crucial role in the operators' drive to rationalize production. When industry leaders began agitating in 1909 for the training of logging engineers, the forestry schools of the region's universities eagerly responded, putting a new emphasis on productive efficiency in place of traditional forestry training. Therefore, while the focus of this study is the workplace, it tries in a limited way to follow the mechanisms of control to their source, to examine the role of universities and government officials in conditioning class relations at the workplace.

The idea for this thesis originated in a reading of Harry Braverman's Labor and Monopoly Capital. Braverman's analysis of capitalist production, drawn largely from the work of Marx, stimulated a renewed interest in labour process research, as witnessed by the appearance of numerous books and articles and a lively debate concerning the adequacy of his analysis, appropriately termed "Bravermania" by two British sociologists.[4] Because Braverman's argument and the interest it has sparked among sociologists and historians have contributed many of the "organizing ideas and presuppositions"[5] of this study, some discussion of the relevant issues this literature has raised is appropriate.

This study is informed by the distinction drawn by Marx, and subsequently applied by many labour process analysts, between labour power and actual work performed. As Braverman writes, "What the worker sells and what the capitalist buys, is not an agreed amount of labour, but the power to labour over an agreed period of time."[6] The consequence of the need to transform this potential into actual work is the exertion of managerial control. According to Braverman, this is manifested as the separation of conception and execution, first explicitly advocated by Frederick W. Taylor.[7] Taylor insisted that all planning and design work be done by management, not skilled workers as was the tradition in craft production. Only by the removal of "all possible brain work" from the shop floor and its concentration in planning departments could capital gain full control over the labour process. Braverman asserts the continuing importance of Taylorism, calling it the "explicit verbalization of the capitalist mode of production" and the "bedrock of all work design."[8] The result, then, has been the deskilling and degradation of work in monopoly capitalism. Capital controls the design of work and dictates the pace of production through the division of labour, machine pacing and/or close supervision. The mass of workers involved in direct productive activity perform routine tasks which are devoid of any meaningful intellectual content.

The validity of Braverman's depiction of the transition from industries which had their origins in artisanal or craft production to modern science based industries seems clear, as several works have shown.[9] Its applicability to staple extractive industries seems more problematic, although studies of the hardrock and coal mining industries seem to reveal a general trend toward the deskilling of workers through mechanization and the fragmentation of work into smaller segments. Even these industries featured a high degree of control by individual skilled workers over the entire production process however. Both Wallace Clement, in his study of hardrock mining, and Keith Dix, in his analysis of coal mining, describe miners in pre-mechanized operations as craftsmen.[10] This emphasis on craft production is interpreted by some as a weakness of this area of research, neglecting the vast majority of workers who, as Al Szymanski points out, "never had either all around knowledge of, or basic control over, the production process."[11] With the exception of hand logging,[12] coastal logging has involved a cooperative labour process, featuring a fairly rigid division of labour. Certain occupations have exhibited high degrees of control over both the conduct of operations and the pace of production, however, and while this study does not represent a rigid testing of Braverman's thesis, its central preoccupation is with the issue of control.

Braverman's thesis suggests that there is a relationship between employer control and worker skill such that as the former increases the latter inevitably declines through the separation of conception and execution, mechanization and the division of labour. The conception of skill applied here is that formulated by Alan Fox, in which jobs are seen to be composed of two elements: task range and discretionary content.[13] The task range of occupations is conceptualized as ranging from narrow to wide. Discretionary content can be evaluated in terms of the type of behaviour required. Roles may be defined specifically, necessitating little choice or discretion, or diffusely defined, entailing a higher degree of discretion. Occupations of this nature require "not trained obedience to specific external controls, but the exercise of wisdom, judgement [and] expertise." Therefore, Fox explains

> the control comes from within--it is, in the literal sense, self-control. The occupant of the role must himself choose, judge, feel, sense, consider, conclude what would be the best thing to do in the circumstances, the best way of going about what he is doing.[14]

A high degree of worker skill, then, equates to a correspondingly high degree of control over the production process. Accordingly, capital seeks to wrest this control from those involved in direct productive activity in order to effect the transformation of labour power into work performed on its own terms, not those of the worker.

After an introductory chapter on the characteristics of the coastal forest and the structure of the lumber industry, Chapter II interprets the process of technological change, not just by analyzing what operators and engineers have written about the subject, but also by examining how these developments affected the nature of work on the logging crew.

Chapter III examines the development of the logging engineering profession. Meiskins attributes the rise of the engineering profession to the demand for scientific labour, a product of three related factors: the growing complexity of production; the importance of supervision and coordination in the collective labour process; and, the separation of conception and execution. Thus, as technological change and the rationalization of work have deskilled the blue-collar worker, the engineer has assumed responsibility for design and planning, performing much of the mental labour formerly done by production workers.[15]
Our purpose here will be to determine when, and to what extent the planning of operations passed from those involved in production to trained engineers. In other words, is the separation of conception and execution which has destroyed the autonomy of craft workers, and which Braverman asserts is the fundamental core of capitalist production,

apparent in the logging industry?

The most controversial aspect of Braverman's argument is his contention that his study is about "the working class as a class _in itself_, not as class _for itself_."[16] This conscious neglect of class consciousness and class struggle has drawn the criticism of several writers, including Michael Burawoy, Richard Edwards and Andrew Friedman.[17] They argue that worker resistance plays an important part in structuring the labour process, forcing managers to adopt less oppressive strategies of control than Taylorist methods. Friedman, for example, maintains that direct control, "the attempt to limit the scope for labour power to vary by coercive threats, close supervision and minimizing worker responsibility"[18] was brought to a peak by scientific management. But worker dissatisfaction and unrest was generated by the increasingly rigid division of labour and the separation of conception and execution, forcing capital to adopt less restrictive control mechanisms, which he terms "responsible autonomy." Resistance, then, must be seen as a force "thrown up by the basic mode of production" which influences the structure of the labour process. Whether one agrees with Friedman, that job rotation and work groups constitute a real alternative to direct control, or with Braverman, who calls the practitioners of human relations "the maintenance crew for the human machinery,"[19] this line of argument points out the importance of engaging in labour process study in terms of what John Storey terms a dialectical approach.[20] This necessitates that attention be focused not just on the actions of capitalists and managers, but to the ways in which the individual and collective resistance of workers may have forced changes in managerial strategies.

In its emphasis on the objective features of work--the actual composition of the labour process as structured by technology and the division of labour--this study stops short of exploring the relationship between operators and loggers in its entirety. In fact, as I have argued elsewhere, the individual and collective resistance of loggers to their conditions of employment played an important role in determining aspects of the employment relationship during the period under study.[21] During the early twentieth century the collective resistance of loggers was expressed in widespread support for the Industrial Workers of the World [IWW].[22] When the IWW's seizure of control of the coastal lumber industry in the summer of 1917 coincided with the American entry into World War I, timber capital and the state entered into a partnership which had as its objectives the destruction of the IWW and the conversion of its supporters into loyal, efficient participants in the war effort. Facing a critical labour shortage and a heavy war-inspired demand for lumber, the federal government was compelled to intervene and proclaim the eight-hour day and improve conditions in the camps under the banner of the Loyal Legion of Loggers and Lumbermen, the United States Army sponsored patriotic organization of employers and loggers.[23]

The individual resistance of loggers, manifested in the extremely high rate of labour turnover which characterized the industry[24] also generated changes in the nature of the employment relationship. Loggers quit to obtain higher wages, to move to a better camp, to escape from a hazardous operation or a particularly oppressive foreman, or because they had accumulated sufficient wages to spend a few days in town. Above all, quitting was an act of resistance. "If I didn't like it," recalled one Washington logger, "I just quit."[25] The geographic mobility of loggers was also a rational, even ordered response to the development of industrial capitalism. By moving freely throughout a region and establishing a reputation as an efficient worker, a logger could exploit competition for his services when the industry was active, and ensure employment during slack periods. Mobility also enabled loggers to acquire a broad range of skills and gain familiarity with a variety of logging systems. Learning "new games . . . different ways" was an important means of enhancing earning power and asserting independence from individual employers.[26]

Improvements in living conditions, including the provision of family housing, schools and recreational facilities, incentive payment plans and company sponsored life and disability insurance schemes were implemented by logging operators to reduce labour turnover and undermine the appeal of the IWW by creating the appearance of a unity of interests between employers and workers. Loggers, it was hoped, would stay on the job longer and reject the class conscious doctrines of the IWW in favour of the benefits of industrial partnership. It is evident, then, that shorter hours, better living conditions and the opportunity for some to keep families intact was the result of the blend of individual and collective resistance.

But while the struggle of the loggers gave rise to significant changes in hours of work and conditions which were peripheral to the production process, there is no evidence to suggest that their resistance to developments in technology and the division of labour which determined the characteristics of their work met with any success. The efforts of timber capital to reorganize the production process did not go unchallenged, but these protests did not forestall changes in productive techniques. Moreover, an evaluation of the task range and discretionary content of these occupations over time confirms the general thrust of Braverman's deskilling thesis.

Any explanation of change in the labour process of the coastal logging industry must recognize that logging involves not only a relationship between man and nature, but a set of relations between capitalists and workers. To ignore either the powerful geographic and staple based obstacles operators faced, or the social relations of production, would vitiate any analysis. Nevertheless, this study argues that the characteristics of coastal terrain and timber constituted only the background, or initial set of circumstances which confronted operators. Their efforts to enhance the efficiency of their operations were directed at the largest and most variable element of their production costs--labour.

Where, then, did the quest for efficiency lead? The argument presented here is that for the operators, efficiency was synonymous with control. In its technological component operators increased productivity and lowered unit costs through the direct replacement of workers with machinery, and reduced the degree of control skilled workers exerted over the production process. Similarly, the development of logging engineering instruction at western universities was a result of the operators' need to reassert control over the conception and planning of operations in the face of the growth in size of their enterprises. All of this is not to suggest that the operators arrived at the desired level of control over the planning and day-to-day conduct of their operations, or the industry's work force. For reasons that will be explained in the text, this goal eluded their efforts.

Some discussion of the limitations of the study which relate to sources and approach is appropriate. The sources fall into four main categories. The most important source of data are management publications, most notably the West Coast Lumberman and the Proceedings of the Pacific Logging Congress, the annual meeting of western operators which served as a forum for discussion of technological and managerial problems. As Jeremy Brecher has pointed out, "It is not always evident how much these sources describe the reality of work, how much one or another management ideology or public relations objective."[27] They are, however, a consistent source which when interpreted critically, reflect the concerns of operators and the course of technological and managerial change. Ideally the Timberman, a Portland journal, would also have been researched, but time limitations precluded systematic examination of this source.

A second source of data includes the scattered reminiscences of, and interviews with, veteran operators and loggers. These data, plus those contained in contemporary accounts and descriptions of logging operations, have been combined with information in management journals and photographic evidence to identify as closely as possible the organization of work associated with the major power sources and systems of coastal logging. Obviously, this provides a less than complete representation of the content of all occupations over time, and how they might have been affected by technological change or modifications to the division of labour. Nevertheless, a clear understanding of how the most skilled occupations have been affected by these changes has been gained.

The third major source of data is the records of the University of Washington College of Forest Resources. This collection, plus information from the industry journals and the reports of the Logging Congress has provided insight into the inception and goals of the logging engineering programs, the relationship of the school to the region's prominent operators, and the experiences of the engineers.

Fourth, the records of the Port Blakley Mill Company and the Merrill and Ring Lumber Company, two Washington state firms, were researched. Access to these collections was limited, however, and much work remains to be done with these and other collections at the University of Washington Archives. Therefore, as the historical endeavour must inevitably fail to capture the entirety of that aspect of the past which is explored, this thesis falls somewhat short of a "complete" history. In terms of sources, more exposure to company records would have been of benefit. The most serious shortcoming, although certainly not unique to this study, is the paucity of data generated by workers themselves. Our view of their motivations and actions is largely filtered through a managerial perspective which can both reveal and distort.

In terms of approach, in treating the coastal region of Oregon and Washington as a whole, local variations have undoubtedly been glossed over. Furthermore, this thesis is concerned with the largest and most progressive firms, rather than with the coastal industry as a whole. This focus has largely been dictated by the sources, which provide a good deal more information on the activities of these companies than those in the "gyppo" sector of the industry.

Finally, one last word on what this study does accomplish. It confirms what Bryan Palmer has correctly identified as the "basic unity" of the technological and managerial reforms which transformed industry at the beginning of the twentieth century.[28] The argument presented here is that technological innovation and engineering were interrelated elements of a structure of control, and that a clear understanding of the parts requires an examination of the whole which they constituted.

Footnotes

[1]See Ralph W. Hidy, Frank Ernest Hill and Allan Nevins, Timber and Men: The Weyerhaeuser Story (New York: The Macmillan Co., 1963); Edwin T. Coman Jr. and Helen M. Gibbs, Time, Tide and Timber: A Century of Pope and Talbot (Stanford: Stanford University Press, 1949); Robert E. Ficken, Lumber and Politics: The Career of Mark E. Reed (Seattle: University of Washington Press, 1985); Thomas R. Cox, Mills and Markets: A History of the Pacific Coast Lumber Industry to 1900 (Seattle: University of Washington Press, 1974).

[2]For example, Robert L. Tyler, Rebels of the Woods: The IWW in the Pacific Northwest (Eugene: University of Oregon Books, 1967); Jerry Lemacke and William M. Tatum, One Union in Wood: A Political History of the International Woodworkers of America (Madeira Park: Harbour Publishing Co. Ltd., 1984).

[3]See Ralph W. Andrews, Glory Days of Logging (Seattle: Superior Publishing Co., 1958); Ed Gould, Logging (Saanichton: Hancock House, 1975).

[4]Craig Littler and Graeme Salaman, "Bravermania and Beyond: Recent Theories of the Labour Process," Sociology 26 (May 1982), pp. 251-69.

[5]Phillip Abrams, "History, Sociology, Historical Sociology," Past and Present 87 (May 1980), p. 9.

[6]Harry Braverman, Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century (New York: Monthly Review Press, 1974), p. 54.

[7]For discussions of Taylor and scientific management see Daniel Nelson, Frederick W. Taylor and the Rise of Scientific Management (Madison: The University of Wisconsin Press, 1980); Craig Littler, "Understanding Taylorism," British Journal of Sociology 29 (June 1978), pp. 185-202; Samuel Haber, Efficiency and Uplift: Scientific Management in the Progressive Era, 1890-1920 (Chicago: The University of Chicago Press, 1964). Judith A. Merkle, Management and Ideology: The Legacy of the International Scientific Management Movement (Berkeley: University of California Press, 1980); Reginald Whitaker, "Scientific Management as Political Ideology," Studies in Political Economy 2 (Autumn 1979), pp. 75-107.

[8]Braverman, p. 86.

[9]See Katherine Stone, "The Origins of Job Structures in the Steel Industry," Review of Radical Political Economics 6 (Summer 1974), pp. 113-74; David Brody, Steelworkers in America: The Nonunion Era (New

York: Harper Torchbooks, 1960); Craig Heron, "The Crisis of the Craftsman: Hamilton's Metal Workers in the Early Twentieth Century," Labour/Le Travailleur 6 (Autumn 1980), pp. 7-48; Craig Heron, "Hamilton's Steelworkers and the Rise of Mass Production," Historical Papers/Communications historiques (Ottawa, 1982), pp. 103-32; Gregory S. Kealey, "The Honest Workingman and Workers' Control: The Experience of Toronto Skilled Workers, 1860-1892," Labour/Le Travailleur 1 (1976), pp. 32-68; Bryan D. Palmer, A Culture in Conflict: Skilled Workers and Industrial Capitalism in Hamilton, Ontario, 1860-1914 (Montreal: McGill-Queen's University Press, 1979).

10 Wallace Clement, Hardrock Mining: Industrial Relations and Technological Changes at Inco (Toronto: McClelland and Stewart, 1981), p. 161; Keith Dix, "Work Relations in the Coal Industry: The Handloading Era, 1880-1930," in Case Studies on the Labor Process, ed. Andrew Zimbalist (New York: Monthly Review Press, 1979), p. 163.

11 Al Szymanski, "Braverman as a Neo-Luddite," The Insurgent Sociologist 8 (Winter 1978), p. 48; see also Paul Thompson, The Nature of Work (London: The Macmillan Press, 1983), p. 91.

12 For descriptions of hand logging see W. H. Jackson and Ethel Dassow, Handloggers (Anchorage: Alaska Northwest Publishing Co., 1974).

13 Alan Fox, Beyond Contract: Work, Power and Trust Relations (London: Faber and Faber, 1974), p. 19.

14 Ibid.

15 Peter Meiskins, "Science in the Labor Process: Engineers as Workers," in Professionals as Workers: Mental Labor in Advanced Capitalism, ed. C. Derber (Boston: G. K. Hall, 1982), p. 1265; see also David Noble, America by Design: Science, Technology and the Rise of Corporate Capitalism (New York: Alfred A. Knopf, 1977).

16 Braverman, pp. 26-27.

17 See Michael Burawoy, "Toward a Marxist Theory of the Labour Process: Braverman and Beyond," Politics and Society 8 (1978), pp. 247-312; Michael Burawoy, The Politics of Production: Factory Regimes Under Capitalism and Socialism (London: Verso, 1985); Richard Edwards, Contested Terrain: The Transformation of the Workplace in the Twentieth Century (New York: Basic Books, 1979); Andrew Friedman, Industry and Labour: Class Struggle at Work and Monopoly Capitalism (London: Macmillan Press, 1979); David Stark, "Class Struggle and the Transformation of the Labor Process," Theory and Society 9 (January 1980), pp. 89-130.

18 Friedman, p. 51.

[19]Braverman, p. 87.

[20]John Storey, Managerial Prerogative and the Question of Control (London: Routledge and Kegan Paul, 1983), p. 6.

[21]Richard A. Rajala, "The Rude Science: Technology and Management in the West Coast Logging Industry," B.C. Studies Conference, 1986; Richard A. Rajala, "Technological and Managerial Change in the West Coast Lumber Industry," A Micro History Workshop: Theory and Method for Regional Study, University of Victoria, 1986.

[22]For accounts of the IWW in the coastal lumber industry see Tyler; Melvyn Dubofsky, We Shall Be All: A History of the Industrial Workers of the World (Chicago: Quadrangle Books, 1969); Robert E. Ficken, "The Wobbly Horrors: Pacific Northwest Lumbermen and the Industrial Workers of the World, 1917-1918," Labor History 24 (Summer 1984), pp. 325-41; James Rowan, The IWW in the Lumber Industry (Seattle: Lumber Workers Industrial Union, 1919).

[23]For information on the loyal legion see Harold Hyman, Soldiers and Spruce: Origins of the Loyal Legion of Loggers and Lumbermen (Los Angeles: University of California, 1963); Cloice R. Howd, Industrial Relations in the West Cost Lumber Industry (Washington, D.C.: Government Printing Office, 1924).

[24]A 1917 study of thirty-nine coastal logging camps by a University of Washington sociologist found an annual turnover rate of 660%. See William F. Ogburn, "Causes and Remedies of Labor Unrest in the Lumber Industry," University of Washington Forest Club Annual 6 (1918), pp. 11-14.

[25]Peter F. Jaspers, Interviewed by David L. Myers, 2 March 1976, Washington State Oral/Aural History Project.

[26]Ray Raphael, Tree Talk: The People and Politics of Timber (Covelo: Island Press, 1981), p. 12.

[27]Jeremy Brecher, "Uncovering the Hidden History of the American Workplace," Review of Radical Political Economics (Winter 1978), p. 4.

[28]Bryan Palmer, "Class, Conception and Conflict: The Thrust for Efficiency, Managerial Views of Labor and the Working-Class Rebellion," Review of Radical Political Economics (1975), p. 34.

CHAPTER I

STRUCTURE AND ECONOMICS

West of the Cascade mountains in Oregon and Washington coniferous forests consisting mainly of Douglas fir, Sitka spruce, red cedar and hemlock cover an area ranging from thirty to 150 miles wide.[1] Exploitation of these forests has primarily involved the predominant species of the region, the Douglas fir. Valued for its combination of strength, light weight and durability, it has been a material of primary importance in the construction and shipbuilding industries and was widely used for bridge and mine timbers and railway ties. Although the red cedar has long been used for roofing and siding, and the Sitka spruce and hemlock attained commercial value in the second and third decades of the twentieth century, the Douglas fir has remained pre-eminent in terms of commercial significance.

The mild climate, heavy rainfall and humidity of the coastal region have produced forests that are characterized by large tree size, the density of the stands and a large yield per acre.[2] The mature Douglas fir averages more than 190 feet in height, often reaches as high as 250 feet, and can exceed eight to ten feet in diameter. The sheer size and weight of such trees, the dense underbrush which often covers the forest floor, and the irregularity of the terrain contronted lumbermen anxious to harvest these forests and made the logging techniques of other regions inapplicable to the coastal setting.

Moreover, the snow which facilitated the transportation of logs in the east and midwest fell infrequently, did not pack firmly, and ultimately hindered logging operations.

Very briefly, the coastal logging operation "from stump to dump" consists of three stages: first, the falling of the tree and bucking of the log into appropriate lengths; second, the "yarding" or "skidding" of the logs from where they lay in the woods to a central point where they are gathered for the final stage, transportation to the sawmill.[3] During the period under study in the coastal region falling and bucking methods underwent little change. Pairs of fallers standing on springboards to avoid the flaring and pitchy butts of the Douglas fir employed double-bitted axes, wedges and crosscut saws, which came into use around 1880, to fall the trees.[4] Working singly, buckers used crosscut saws to cut the logs into the correct lengths.[5]

Innovations in yarding involved the replacement of oxen and horses by the steam engine or "donkey" during the last fifteen years of the nineteenth century, and the transition from ground-lead yarding involving steam power, to overhead systems of logging in the second decade of the twentieth century. Steam donkeys were fired by wood during the entire period, but progressive firms initiated the use of oil as a fuel during the 1910-1920 period, and gasoline and diesel powered internal combustion engines began to appear during the late 1920s.

The third and final step in the process, the transportation to coastal waters or direct to the sawmill, was accomplished first by floating logs down rivers during the winter freshets or by building splash dams on smaller streams which when opened would release a sufficient amount of water to carry logs downstream. By the 1880s the first logging railroads were beginning to appear on Puget Sound.[6] Although the use of rivers continued, firms with sufficient capital gradually moved to railroads and then during the 1940s and 1950s to logging trucks as the main form of transportation.[7]

The technological changes briefly described above took place against a backdrop of significant change in the structure of the logging industry which saw a steady growth in the size of units of capital and the scale of operations. Large-scale production in the sawmilling sector of the lumber industry dates from the 1850s. Two Maine lumbermen, Andrew Jackson Pope and William C. Talbot established the Puget Mill Company at Port Gamble in 1852. The Port Blakely Mill Company commenced operations on Puget Sound in 1864, and the Tacoma Mill Company's sawmill was established on Commencement Bay in 1869.[8] But these and other less extensive sawmilling operations usually bought their logs from small, independent logging operators who had easy access to timber situated close to coastal waters and rivers. As late as 1882, for example, the Port Blakely Mill Company obtained its logs from thirty-two logging camps located around Puget Sound. The company advanced supplies, equipment and sometimes cash to the independent operators who employed small crews working with oxen to put logs into the Sound, which were sold on an open market.[9]

Several factors combined during the late nineteenth and early twentieth centuries to effect a transformation in the structure of the logging industry from one marked by many small producers, to one dominated but not controlled by large firms. First, the completion of the Northern Pacific Railroad to Portland in 1887 and the arrival of the Great Northern Railroad in Seattle in 1893 provided transcontinental rail links to an expanding American economy, stimulating a surge of regional growth. The population of Washington, which stood at 23,955 in 1870, grew to 357,232 in 1880, edged upward during the depression of the 1890s to 518,103 and in 1910 reached 1,131,990.[10] Recent scholarship suggests that it was the construction of the railroads, this internal development and the expansion of Pacific markets in California, South America, Hawaii, Australia and China which contributed to the initial growth of the western lumber industry. Cox argues that prohibitively high freight rates prevented immediate rail access to eastern and midwestern American markets.[11] However, the transcontinentals established important preconditions for the transition to large-scale production in the logging industry by attracting population and capital to the northwest, spurring regional development and eventually providing access to a growing domestic market.

The industry exhibited its greatest expansion during the 1880s, as production in Washington rose from 160,176,000 board feet in 1879 to a billion board feet in 1889.[12] The slump of the 1890s slowed the rate of growth, but by 1905 Washington led the nation in lumber production and in 1909, the cut was over three and one-half billion board feet.[13] A year later 63.3 percent of the wage earners in the state were directly dependent upon the lumber industry.[14] In most coastal counties lumbering was the cornerstone of a regional economy based on resource extraction. A 1923 study of nineteen western Washington counties found that 661 logging firms employed 24,944 workers.[15]

Of more direct importance in fostering the tendency toward an increase in capitalization and growth in the scale of operations was the elimination of smaller timber tracts near coastal waters or rivers which could be worked with minimal capital. As logging railroads came into use during the 1880s and 1890s to reach less accessible timber, capital requirements increased sharply.[16] In order to spread the fixed costs of railroad construction, maintenance and operation as thinly as possible, a large railroad logging firm would operate several logging camps along the line, each of which would be the scene of multiple yarding operations, or "sides." Some mill companies with surplus capital which were anxious to secure a supply of logs for their expanding sawmill facilities and gain a measure of independence from logging operators who were charging higher prices for logs established their own logging operations.[17] One of the first mill companies to open its own logging camps was the Port Blakely Mill Company. After an official of the company observed in 1884 that "the timber contiguous to [Puget] Sound is nearly exhausted," the firm contracted with Sol Simpson for the construction of one of the early logging railroads in the region,[18] and by 1888 about 200,000 feet of logs were being hauled over the road each day.[19] The depression of the 1890s provided a second, and often final blow for many small operators who were already struggling under higher logging costs.[20] Although sawmilling firms began logging operations and logging companies bought or built their own sawmills, the coastal lumber industry was not characterized by this kind of integration until the latter part of the period under study. Large independent logging firms continued to sell their product to sawmills in the Grays Harbor, Puget Sound and Columbia River log markets.

While these developments were taking place in the northwest, lumber capitalists in the east and midwest were confronted with the depletion of their timber resources in those regions. Accordingly, their attention turned to the vast and relatively untouched timberlands of the Pacific states. Frederick Weyerhaeuser's purchase of 900,000 acres from the Northern Pacific in 1900 both symbolized and heightened the movement of capital into the northwest, touching off a wave of speculative activity that drove the price of timberlands upward. Merrill and Ring moved to Puget Sound from Michigan and Wisconsin, Robert and Alex Polson transferred their operations from Nova Scotia to Grays Harbor, and C. A. Smith and Al Powers relocated in Oregon's Coos Bay region from Minnesota.[21] These were just a few of the prominent logging operators who had amassed fortunes in other areas and came west, altering the pattern of timber ownership from one of small holdings to one marked by "the great concentration of ownership over vast acreages of forest lands."[22]

The railroad land grants served as the basis of many of the timber empires, but the lumber companies were also able to turn federal land laws to their advantage in amassing forest lands. The Homestead

Act of 1862, ostensibly formulated to insure the dispersal of western land to small holders, stipulated that individuals could file on 160 acres of land for a fee of $10.00. Once a five year residency requirement was satisfied a patent on the land was granted, or, for the price of $1.25 per acre the residence and cultivation requirements could be waived. Companies employed dummy entrymen to file on claims which, with the cooperation of land officials, were turned over to the company for a small fee.[23] Archie Binns provides an extreme example of this practice, citing the case of one lumber company that paid the members of ships crews $5.00 each to file on timber lands which were then transferred to the company.[24] Similar results accompanied the passage of the Timber and Stone Act of 1878, which enabled individuals in the western states to purchase 160 acres of public timberlands, for personal use only, at $2.50 per acre. Corporations enlisted employees and others to enter claims on these lands which were then conveyed to the company.

The timberlands acquired by lumber companies constituted a heavy burden of fixed costs in the form of interest payments, taxes, and expenses for fire protection. Taxes on Washington land, for example, began to rise in 1905 and tripled between 1910 and 1920.[25] Operators were accordingly encouraged to liquidate their holdings as quickly as possible in order to gain some relief from these costs. The result, according to Whitten, was to further the trend toward concentration. In order to spread the fixed costs of taxes, interest payments and fire protection as thinly as possible and reduce per-unit costs, firms invested heavily in logging railroads and steam-powered harvesting systems, further increasing the burden of fixed costs and prompting the acquisition of more timber to insure that such equipment could be used in the future.[26]

By the end of the first decade of the twentieth century the new and disturbing pattern of timber ownership was apparent. In 1913 the Weyerhaeuser Timber Company held 26.1 percent of the privately owned timber in Washington, and together with the Northern Pacific Railroad possessed 45.7 percent.[27] By 1914 over half of the privately owned timberland in the American northwest was in the hands of only thirty-eight companies.[28]

Although the ownership of timber in the northwest was marked by extreme concentration, enough small operators persisted to deprive the giants of monopolistic control. By the early 1900s then, the coastal lumber industry was divided into two sectors, a sizeable group of marginal operators and a smaller group of companies with large holdings and great productive capacity which dominated but did not completely control the industry.[29]

The burden of fixed costs and the compulsion to liquidate the resource which it engendered was in part responsible for another defining characteristic of the industry--that of overproduction. Coastal operators paying high interest rates on mortgaged timber lands and facing increasing taxes and fire protection costs were encouraged to produce regardless of the condition of the lumber market. For example, when the Merrill and Ring Lumber Company encountered a poor market for logs in 1911, T. D. Merrill advocated the continued production of a large quantity of logs rather than curtailment because

> in the first place it pays indebtedness, in the second place because the increase in quantity lowers cost and in the third place we . . . will have secured some good customers and will be in full swing should the market improve.[30]

Moreover, the lumber market fluctuated wildly, prices often varying by as much as 50 percent within one year, making it extremely difficult to coordinate production with demand.[31]

Operators of coastal firms troubled by a volatile market also faced severe competition from substitute building materials. Per capita consumption of lumber products in the United States declined as alternative materials such as bricks and cement grew in popularity for construction purposes.[32] Consequently, the productive capacity of the industry exceeded demand, perhaps by as much as 25 percent.[33] The lumber market itself was marked by extreme intraregional and interregional competition. Marginal firms in some areas were able to move in and out of the market according to demand, curtailing production when prices fell, then resuming activity when prices warranted.[34] Competition from the American south and Canadian lumber producing regions in conjunction with the presence of these small producers, effectively deprived coastal operators of the ability to control the market. Organizations created to establish grades, fix prices and restrict competition ultimately failed to extend monopolistic control over the industry.[35]

In summary, the operator's relationship to the market was characterized by an absence of control. The pressure to mechanize and liquidate the resource as rapidly as possible manifested itself in a rate of production that often exceeded demand. Faced with a wildly fluctuating market, a long-term reduction in per capita consumption and severe competition, survival was dependent upon achieving the lowest cost per unit possible. Therefore, their behaviour with regard to the market accentuated the operators' drive to rationalize their logging operations. Of course, capitalists and managers in other less competitive sectors of the economy launched similar attempts, but the logging operators' lack of success in gaining control over the market provided them with a compelling incentive to effect a more rigid control over the production process.

Footnotes

[1]Stewart H. Holbrook, Holy Old Mackinaw: A Natural History of the American Lumberjacks (New York: The MacMillan Co., 1945), p. 161.

[2]Hugo Winkenwerder, Forestry in the Northwest (Washington, D.C.: The American Tree Association, 1928), p. 13.

[3]Nelson C. Brown, The American Lumber Industry (New York: John Wiley & Sons, 1923), pp. 36-37.

[4]Lester W. Patterson, "A History of Lumbering in the Douglas Fir Region" (M.A. thesis, College of Puget Sound, 1951), p. 41; for a description of falling methods see Alfred W. Moltke, Memoirs of a Logger (College Place: College Press, 1956), pp. 61-62.

[5]For an excellent description of bucking methods see Bus Griffiths, Now You're Logging (Madeira Park: Harbour Publishing Co., 1978), p. 90.

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[8]David O. Whitten, The Emergence of Giant Enterprise, 1860-1914 (Westport: Greenwood Press, 1983), pp. 142-43.

[9]Richard C. Berner, "The Port Blakely Mill Company, 1876-89," Pacific Northwest Quarterly 57 (Oct. 1966), p. 159.

[10]Jonathan Dembo, Unions and Politics in Washington State, 1885-1935 (New York: Garland Publishing, 1983), p. 41; Coman and Gibbs, p. 211.

[11]Cox, Mills and Markets, pp. 199-205; see also Thomas R. Cox, "Lower Columbia Lumber Industry," Oregon Historical Quarterly LXVII (June 1966), p. 177.

[12]Cox, Mills and Markets, p. 301.

[13]Charles M. Gates, "A Historical Sketch of the Economic Development of Washington Since Statehood," Pacific Northwest Quarterly 39 (July 1948), p. 216.

[14]Winkenwerder, Forestry in the Northwest, p. 11.

[15]Victor H. Beckman, "Survey of the Lumber Industry of Western Washington" (Sept. 15, 1923), p. 5. Pacific Northwest Collection, University of Washington.

[16]Clarence A. Hogan, "The Historical Development of the Lumber Industry of the Pacific Northwest" (Senior thesis, Reed College, 1921), p. 46; Alvin Hovey-King, "The Lumber Industry of the Pacific Coast," American Review of Reviews 27 (March 1903), p. 318.

[17]Cox, Mills and Markets, p. 126; Berner, p. 163.

[18]Berner, p. 161.

[19]Ficken, Lumber and Politics, p. 13.

[20]Whitten, p. 144; Hovey-King, p. 318; Hogan, p. 46.

[21]Holbrook, Holy Old Mackinaw, pp. 155-56; Robert E. Ficken, "Weyerhaeuser and the Pacific Northerwest Timber Industry, 1899-1903," Pacific Northwest Quarterly 70 (Oct. 1979), pp. 146-54; William G. Robbins, "Timber Town: Market Economics in Coos Bay, Oregon, 1850 to the Present," Pacific Northwest Quarterly 75 (Oct. 1984), pp. 148-49.

[22]Dorothy O. Johansen, Empire of the Columbia: A History of the Pacific Northwest (New York: Harper & Row, 1967), p. 402.

[23]Robbins, p. 149; Raphael, p. 5; Johansen, p. 401.

[24]Archie Binns, The Roaring Land (New York: Robert M. McBride Co., 1942), p. 61.

[25]Ficken, Lumber and Politics, pp. 63-65; Coman and Gibbs, p. 227.

[26]Whitten, pp. 135-36.

[27]Johansen, p. 402.

[28]Hogan, p. 57.

[29]Hidy, Hill and Nevins, p. 214; Johansen, p. 404.

[30]T. D. Merrill to Tiff Jerome, January 23, 1911, Merrill and Ring Lumber Company Records, Box 5, University of Washington Libraries.

[31]Johansen, p. 403.

[32] R. W. Vinnedge, The Pacific Northwest Lumber Industry and Its Development (New Haven: Yale University School of Forestry, 1923), p. 18.

[33] Cox, Mills and Markets, p. 225; Charlotte Todes, Labor and Lumber (New York: Arno Press, 1975), p. 31.

[34] Vernon H. Jensen, Lumber and Labor (New York: Farrar & Rinehart, 1945), p. 29.

[35] Johansen, p. 404.

CHAPTER II

THE FOREST AS FACTORY

This chapter examines in some detail the production process involved in the exploitation of the coastal forests over the period under study. The chapter argues that the course of technological innovation reveals a progressive alienation of the control that loggers exerted over production. As firm size increased and logging railroads made logging a more capital-intensive endeavour, new technologies were developed to accelerate the harvesting of the resource. Skills that had rested with loggers were appropriated or made redundant by complex yarding systems which reduced the discretionary content of occupations and effected a more intense transformation of labour power into work performed.

Pressured by the demands of competition in a capitalist economy, logging operators expressed concerns common to industrial capital. Higher productivity, lower costs, and the ultimate goal--greater profits--were their frequently stated objectives. But a recognition that the first priority of the capitalist enterprise is not control *per se* but accumulation serves only as the starting point for this study of the workplace. To remain at this level of analysis is to fail to probe deeply enough. The explanation of the historical transformation of the labour process requires that the historian recognize, then look beyond the market relations of capitalists to explore the relationship between employers and workers. Although an explicit concern with control does not surface with great frequency in the historical record, it is clear that each major technological change was accompanied by, and in fact dependent upon a transfer of control from loggers to timber capital. It is equally clear that logging operators and managers were aware of, and welcomed the enhanced managerial control that more sophisticated technologies embodied.

Although the urge to control was rooted in the very nature of capitalist production, it was reinforced in the logging industry by the features of the resource, the environment within which it was situated, and basic characteristics of the harvesting operation. The large size and weight of coastal timber, irregular, stump covered terrain, and constantly shifting location of production contributed to the creation of an unstable productive setting which forced operators to rely heavily upon the skills and initiative of loggers. Frank Lamb, a prominent Grays Harbour operator, alluded to this lack of stability in 1909 at the first Pacific Logging Congress. "The work of the logger is never the same," he remarked,

> Each tree grows in a different location, each behaves a little differently in the handling. Fixed rules of procedure are of little use, every proposition, every location, every camp, every day's work, even every log is a separate engineering proposition.[1]

Minot Davis, the director of logging operations for the Weyerhaeuser Timber Company, contrasted the stability and control of the modern factory setting to the uncertainty of coastal logging operations in a

1922 speech to a group of young logging engineers at the Forest Club of the University of Washington School of Forestry. "In a factory," he asserted,

> once the character of the product is determined, the machinery tried out, and the organization completed, the working conditions are practically uniform from day to day. In the woods, conditions are seldom the same from day to day.[2]

That mechanization was in part a conscious response to the variable nature of human labour power, and not purely the working out of some neutral technological imperative, was clearly expressed by J. D. Young, manager of the Inman-Poulsen Logging Company. Young told the Forest Club in 1915 that,

> While the logger can go to the manufacturer and buy a machine to do a certain unit of work in purchasing labor the proposition is far different. Here there is an element of uncertainty which makes the progressive logger unhappy. At one time a man may do a certain amount of work and later there may be a decided falling off in this amount due to a slackening of ambition, the presence of an agitator in camp, or any one of many other reasons.[3]

Technological innovation offered the most effective solution to this condition, for by establishing steam and diesel powered aerial logging systems, operators were able to reduce their dependence upon the most skilled loggers who exerted a high degree of control over the production process, and subject the entire crew to the discipline of machine pacing. Mechanization and related innovations resulted in significant increases in productivity and reductions in labour requirements, but these quantitative gains were achieved only through a qualitative transfer in control over the production process from workers to operators.

Explanations of technological change in the logging industry have not emphasized the importance of class relations, stressing instead the impact of timber depletion and the increasingly rough terrain firms faced as their operations progressed inland away from easily accessible timber near coastal waters and rivers. For example, Alfred Van Tassel, the author of a study of mechanization in the lumber industry argues that technological innovation can be attributed to the need to maintain labour productivity in the face of declining tree size and a less accessible resource. Thus he writes, "New machines and methods have been developed . . . to meet changes in conditions of accessibility and size of timber."[4] Implicit in this explanation is the assumption that if tree size and accessibility had remained constant, the impetus for technological change would have been nonexistent. Although, these factors cannot be completely discounted, a close look at the historical record indicates that changes in the size and accessibility of the resource were not the most compelling factors in conditioning technological innovation. In addition to the expansion of markets, the desire to liquidate the resource, and the staple-based factors emphasized by most writers, the explanation of technological change in the industry is to be found in an analysis of the production process itself. This necessarily requires attention to the characteristics of the staple and the environment within which it is situated, but more importantly, it demands an examination of the evolving relations between capitalists and workers which are produced. Van Tassel's attention to labour productivity brings class into the picture, but reduces it to a response to the condition of the staple. In fact, class relations functioned as an independent variable in structuring technological and managerial change. Changes in the size and accessibility of the resource alone did not motivate operators and their managers to explore new harvesting methods. Rather, the features of coastal terrain and timber per se, and the relations between capital and labour which logging in this context produced were the key determinants of technological development.

Unlike the owners of manufacturing enterprises who could organize the productive setting on their own terms, in the form of the factory, logging operators were forced to accept the conditions created by nature. Even at its most benign this setting was unpredictable, and the pace of the logging operation was dependent upon the ability of loggers to recognize or "size-up" each situation, conceptualize the proper response, and implement the correct techniques. The mental and physical skills of the workers controlled the process of production. New technologies undermined the autonomy of workers and replaced it with control which flowed from the productive apparatus itself. It was the vision of the factory, and the subordination of workers to the machine which inspired the process of technological innovation.

As indicated in Chapter I the logging operation proper consists of three essential stages: the falling and bucking of the tree; the "yarding" of the log from where it lies in the woods to a central point or "landing"; and finally, transportation to the sawmill. Of the three elements of the logging operation the most costly, the most crucial, and the one most marked by uncertainty was the yarding procedure.[5] Falling and bucking costs varied according to terrain and timber, but were relatively stable. Similarly, the costs involved in the transportation from the landing to tidewater or the sawmill by railroad varied little. In an industry in which direct payments to labour constituted about 50 percent of the total production costs,[6] the yarding operation was the most labour intensive, and the one in which operators were most reliant upon the ability of workers to cope with the unstable productive setting. This stage therefore offered both the greatest incentive and the greatest scope for enhanced control through technological innovations. Our primary concern, then, is with this phase of the operation, of which J. J. Donovan, vice-president of the Bloedel-Donovan Lumber Mills wrote, "more than any other part of the organization, makes or mars the work of a day."[7]

Prior to the widespread adoption of steam-powered logging donkeys in the latter two decades of the nineteenth century, yarding was accomplished by the use of oxen, then horses, dragging the logs out of the woods to skidroads, then down the skidroads to a waterway or logging railroad. Sol Simpson, founder of the Simpson Logging Company, was reputedly the first to replace oxen with horses, which were faster on longer hauls.[8] In 1899 the Pacific Lumber Trade Journal reported that oxen were to be found in but few camps in the Pacific Northwest, that logging horses were still "much in demand," but that the trend toward steam power in yarding was now well under way.[9] As the yarding procedures with oxen and horses were similar in their essential features, they will be discussed together under the heading of animal logging.

Animal Logging

The skidroad was the first and most costly step taken in the establishment of an animal logging operation. After the route into the tract was chosen, the roadway was cleared and graded by crews using picks and shovels. Where the topography necessitated, bridges were built in order to make the roadway as level as possible. Logs or "skids" between six and twenty inches in diameter were placed across the length of the skidroad. In the centre of each skid a notch was cut with an adz, and a section of hardwood was placed, called a "glut," over which the logs would travel. Where curves were necessary the skids were placed closer together and slightly elevated on the inside of the curve to prevent the log from rolling. "It is the placing of the skids," wrote one observer, "that the utmost skill is required."[10] Because of the limited power oxen or horses could supply, the construction had to be to exacting specifications to eliminate all sources of friction which could impede the progress of the logs. A well-built skidroad was a crucial element in the success or failure of the logging operation, and its construction was performed by highly skilled specialized crews or contractors.[11] In essence, the skidroad was the first attempt made to neutralize the irregularity of coastal terrain, for once the log reached the skidroad, a measure of stability or control over the pace of operations had been achieved.

It was in manoeuvring the log from where it lay in the woods to the skidroad that operators were most dependent upon the loggers involved to deal with obstructions and irregular terrain. In fact, one observer wrote that ten logs could be hauled down the skidroad with less effort than was required to move one to that point.[12] Once the tree was felled and bucked the log was prepared for hauling. First, the lead end of the log was bevelled or "sniped" by a worker using an axe, to prevent it from catching on obstructions. Even this apparently simple procedure involved a degree of discretion. If the sniper could determine which side of the log was the "ride" side, that is, which side of the log would naturally come into contact with the skidroad, only that portion needed to be sniped.[13] In addition, barkers removed the bark and any knots from along the ride side of the log. Judgment was also required here, as the barkers had to determine which side was naturally the ride side. So skilled were the axemen at the camp on Vancouver Island operated by Edwin Debeck's father in the 1890s that he recalled, "the perfection of the axe work was so great that the logs appeared as if covered with scales clearly lined."[14] Swampers, sometimes working with horse teams, cleared windfalls and other debris from the area between the log and the skidroad.

Manoeuvring the log into position on the skidroad over ground that was commonly rough and covered by stumps was the task of the two most highly skilled members of the crew, the teamster and hooktender, and his assistant, the hand skidder. A writer who observed the procedure in 1893 described it in the following way:

> Without haste and with an infinite number of pauses, the team was prodded, sworn, and cajoled into position. Meanwhile, an ingeniously simple tackle of pulleys and wire cables was thrown into place, and fastened upon neighbouring trees and stumps. The "Dogs"--half hooks of steel, were driven deeply into the back of the log . . . and the chain from the team was attached to the cables. The heaviest part of the labor of the camp falls upon the hook-tender and his assistant. The log, being generally deeply imbedded from its fall, has to be thrown upon the roadway, often over the roughest, stump covered ground, and a considerable amount of rude science is required to arrange the pulleys and tackle to accomplish this without accident or waste of time.[15]

R. J. O'Farrell, who worked as a hand-skidder in the 1890s, recalls that his strenuous duties involved cutting and placing smaller skids along the path the log would take to the skidroad.[16] Depending upon the distance to the road and the nature of the topography the block and tackle might be used several times to increase the pulling power of the team before the log reached the skidroad. This is where the skill of the hook-tender was crucial. Several holds, such as the "luff" and the "whip" might be used along with multiple blocks to increase power.[17] The luff, remembers Lloyd C. Rogers, could multiply the power of a team thirty-six times.[18]

Expressed in terms of the relationship between skill and control, the logging operator was wholly dependent upon the experience, physical dexterity and judgment or discretion of the teamster and hooktender to cope with the unstable productive setting and the limited power supplied by the team. The yarding of each log represented a "problem" to be solved by the logging crew, with ultimate control over the pace of the operation resting with the teamster, followed by the hooktender. No two logs could be dealt with in exactly the same manner. The procedure would vary according to terrain, the size of the log, the behaviour of the team, the location of stumps, and distance to the skidroad. Control over production rested with the workers, not an outside source.

Once the yarding team had moved several logs to the skidroad, two or more would be coupled together with chains into a "turn" and then hauled down the skidroad by the roading team, usually consisting of six or seven yoke of oxen, or an equal number of horses in a horse-logging operation. Between the last pair of animals and the first log walked the skid-greaser, usually a boy, who carried a container of dogfish oil and swab with which to spread the lubricant on the skids. On the way back up the skidroad he would sweep the accumulation of debris out of the middle portion of the skids.

Written accounts of operations, reminiscences of operators and workers, and the records of the Port Blakely Mill Company support the conclusion that the teamster was the key figure in the animal logging operation. To move the immense coastal logs he had to be able to extract the maximum effort from the oxen or horses, and coordinate the actions of up to fourteen animals to form a cohesive pulling unit. "It was nothing uncommon," wrote George Emerson, an early Grays Harbor lumberman, "for the bull puncher to be the turning point between the success and failure of a logging enterprise."[19] Another early logger recalls that "driving ox teams was an art,"[20] and John Reavis, who observed such a display in 1899, wrote that the position required "great skill and nerve."[21] To a much greater extent than exists between machine operator and machine, the relationship between teamster and team was a personal one. George P. Abdill wrote that the bull puncher "learned to know each bull's characteristics,"[22] and Tony Alexander noted that there had to be a complete accord between the driver and the lead oxen, as the leaders had to understand and act on the teamster's commands and gestures.[23] The recollection of Albert Drinkwater, a former British Columbia horse logger, provides the clearest expression of this aspect of logging with animals. "There is something about the horse that isn't an engine you know," Drinkwater advised,

> There is a little response with a horse and none with an engine. A horse can like you, or he don't like you. He'll work for you or he won't . . . a horse won't work for everybody the same. He'll work for one man and he'll pretend to pull for the other one . . . the horses themselves became . . . a part of the man that drove them.[24]

The teamster, then, exerted a high degree of control over the production process by virtue of his special skills and the rapport with the team. This source of power was augmented by the fact that competent teamsters were rare, forcing operators to compete with each other for their services, a situation that teamsters were only too willing to take advantage of. One contractor who supplied logs to the Port Blakely Mill Company complained in 1878 that a rival operator's offer of a higher wage would "be the means of his getting a good teamster from me."[25] George Emerson wrote in 1908 that the teamster was "liable to quit at a moments notice and shut down the camp."[26] That the teamster's absence put a complete halt to operations, a point also made by George P. Cornwall, the secretary of the Pacific Logging Congress, attests to his prominence in the production process.[27] Wage schedules reflect the position of the teamster in the occupational hierarchy. The records from one Washington camp indicate that he was the highest paid member of the logging crew, earning $10.00 more per month than the hooktender and faller.[28] The teamster's control over the productive process, derived from his skills and his propensity to exploit competition for his unique services, contributed to a position of significant power. The relationship of the operator to the teamster, therefore, was marked by an unacceptable degree of dependence.

All of this is not to suggest that class relations were the only factor conditioning the replacement of animals with steam donkeys. But Van Tassel's explanation, that the adoption of steam powered yarding was necessary because "the timber line receded before the logger's axe," is difficult to accept. It is true that yarding effectively with oxen was limited to a distance of about one mile. Sol Simpson informed the Port Blakely Mill Company in August of 1888 that a haul of over one mile was excessive for his team of oxen which was "too slow on a long road in hot weather."[29] One month later he reported that one of his finest oxen had died from the heat while hauling logs over a skidroad a mile and one-quarter in length.[30] Horses were more effective on longer hauls but the real answer to the increasing distances caused by timber depletion was the railroad. For example, a contractor advised the Port Blakely Mill Company against the construction of a skidroad near Skookum in 1885 because "the road would soon be so long as to take up all the profits and it would soon have to be abandoned for a railroad."[31] Moreover, when steam donkeys first came into use they were employed to yard logs out of the woods to the skidroad. The logs were then hauled down the road by traditional animal power.[32] As the yarding procedure from the woods to the skidroad was the phase of the operation marked by the greatest reliance on the skills of loggers, timber depletion and increasing distance is a less plausible explanation for the first step in the mechanization of yarding than the operators' desire to increase the productivity of and control over the most crucial stage of the logging operation.

As indicated, the control which skilled loggers exerted over yarding was not the sole reason for the mechanization of the procedure. Intense heat slowed logging during the summer months when production was crucial. Heavy rain during the fall and winter often completely curtailed operations. Although loggers cut and placed wooden slats called puncheon along skidroads during rainy weather, this was a time consuming procedure. A frustrated contractor informed the Port Blakely Mill Company in February of 1878 that,

> The weather is so rainy and bad that I cannot do much with the teams . . . the ground is so full of water that I would be obliged to puncheon the whole of my road in order to haul and this would take me until the first of April and the rain will certainly let up by that time.[33]

Another reported to the company in 1887 that heavy rains had "completely driven us out," and that it would be at least two weeks before hauling could resume.[34] Freezing conditions offered little relief, as the hard ground meant that oxen had to be shoed often, a laborious, time consuming procedure.[35] If logging was not a strictly seasonal operation, then, it was certainly adversely affected by coastal weather conditions. But while the switch to steam-powered ground-lead logging provided some advantages in this regard, especially during the summer, wet weather and muddy conditions continued to hinder mechanized logging to a great extent.[36]

There were, in addition, costs associated with animals which did not have to be met with steam engines. Unlike machines, animals had to be trained for the work, which could take up to a year.[37] Feed costs for horses and oxen were high, involved the expense of transportation to isolated camps, and continued even when weather conditions or other factors put a halt to production.[38] The animals themselves were not inexpensive. Simpson paid $1,400.00 for seven yoke of oxen in 1889.[39] The Percheron and Clyde horses which replaced oxen in his camps for a time were even more expensive, costing as much as $500.00 each, and had to be shipped from the east, unlike the oxen which could be obtained from local farmers.[40]

The productivity of these operations was limited. Bully Forbes, a logger interviewed by Stewart Holbrook, estimated that a six-yoke team of bulls could averge four trips, or "turns" per day over a good, level mile long skidroad, each turn consisting of from ten thousand to twelve thousand board feet.[41] Steam engines offered greater power and speed than oxen or horses, required no training, and did not have to be fed when not working. But a possible clue to the relative weight of the advantages associated with steam power is offered by Emerson, who was one of the first Grays Harbor operators to acquire a donkey, in about 1884. In recalling the high wages paid to the teamsters, higher even than the camp foreman, and their propensity to quit on short notice and shut down logging, Emerson wrote that "the elimination of the bull puncher by the introduction of steam was the greatest step forward ever made in the logging business."[42] It is significant that Emerson associates this advance not with the elimination of the animals, but with the displacement of the teamster. Although skills were definitely required to operate the donkey these skills were more easily acquired than those possessed by the teamster. Just as important, the rapport with the team which had made the individual teamster so crucial to a successful logging operation was no longer a factor. Donkey engineers would be replaceable to a much greater degree than teamsters.

In conclusion, steam-powered yarding offered a range of advantages over logging with animals. More powerful, capable of higher speeds, and less effected by weather conditions, the steam engine allowed a more rapid and thorough exploitation of the coastal forests. It is clear, however, that the first step in the mechanization of coastal logging cannot be explained by technical factors alone. Operators eliminated the key figure in animal logging operations by replacing oxen and horses with the steam donkey, and as Emerson's statement regarding the displacement of the teamster shows, class relations figured prominently in this development.

Ground-Lead Logging

Steam-powered logging donkeys came into use in the Pacific Northwest during the 1880s, and from roughly 1895 to 1915 the predominant method of yarding involved the extension of a cable from the hauling drum of the donkey into the woods where it was attached to a log which was then dragged to the landing along the ground. As briefly described in the previous section, ground-lead yarding possessed important advantages over logging with animals. It did not, however, fundamentally transform the productive process. As will be shown through an analysis of the organization of work associated with ground-lead logging, the method failed to free the operators from their dependence upon the physical and conceptual skills of loggers, who continued to exert ultimate control over the conduct and pace of logging. In retrospect, ground-lead yarding represented an interim, unsatisfactory solution to the production problems of timber capital. But at another level this transitional period had great significance. The pattern of technological innovation would change during these years from one marked by the individual and haphazard activity of logging operators to one characterized by the joint participation of timber capital and the engineering staffs of logging equipment manufacturers.

The essential elements of a steam-powered logging donkey consisted of a vertical boiler, engine, and winch mechanism mounted on an iron or steel frame, the entire apparatus usually resting on a wooden sled. The earliest machines were modifications of existing technology, being adapted from the hoisting engines which were commonly used during the nineteenth century as pile drivers and to load and unload ships.[43] The first engine designed for logging on the Pacific coast was the invention of John Dolbeer, a former engineer and machinist who owned a lumber company near Eureka, California, with John Carson. Dolbeer was granted a patent for his side-spool "Steam Logging Machine" in 1882. George D. Gray provided a description of the machine and its operational characteristics in 1883, writing,

> The machine consists of an upright boiler and an engine, except that instead of a reel to wind the rope on it has two "gypsy heads," one on each side of the reel shaft. It sits on a strong frame, the sides of which are like sled runners. It has a strong purchase from the engine to the "gypsy" shaft. To move the machine around the woods they run a line ahead, make it fast to a tree or stump, take two or three turns around the "gypsy," and start up the engine. In this way it hauls itself wherever wanted. When the machine is in place it is made fast to a tree or stump, and a line run to the log to be removed, and by means of snatch-blocks the log is hauled in any direction desired.[44]

In late 1883 Dolbeer received a patent on an "Improved Logging Engine" which featured a vertical spool or capstan.[45] This was probably the first machine used by northwestern logging operators like George Emerson, Sol Simpson and Robert Polson.[46]

In addition to the engineer, the new machines required wood buckers and firemen to fuel the machines, and the spool tender, who took the turns of manila rope off the capstan as the log was pulled in.

After the log reached the machine the cable was fastened to the line horse which, under the direction of a worker, returned it to the next log to be yarded. The increased power the Dolbeer supplied necessitated further innovation, as the blocks, hooks, chains and other rigging which had been strong enough to withstand the forces exerted by horses and oxen had to be replaced.[47] About a year after George Emerson received his Dolbeer he replaced the six-inch manila rope with three-quarter-inch flexible steel cable, requiring a further alteration in rigging. The new steel line was an improvement over the manila rope, however, which had stretched and slipped when wet.[48]

Shortly after the Dolbeer came into use in the coastal woods, engines made by the eastern manufacturers of hoisting equipment such as the Lidgerwood and Mundy began to appear,[49] although some operators found that they were not well suited to the huge coastal timber.[50] Moreover, even after the Lidgerwood company had established a west coast office in Seattle, coastal firms complained about the difficulty encountered in obtaining parts that had to be ordered from New York.[51] The fact that the engineering staffs of these companies were located in the east may also have made it difficult for western operators to obtain the modifications they desired.[52] Northwestern machinery manufacturers like the Washington Iron Works in Seattle and the Willamette Iron and Steel Works in Portland recognized the market potential of the expanding logging industry during the 1890s, and began working in conjunction with coastal logging interests to produce engines designed specifically to satisfy regional demands.[53]

The initial donkeys produced by these western and eastern manufacturers were capable of higher speeds than the Dolbeer, due in part to the development of the horizontal yarding drum which displaced the spool tender.[54] But it wasn't until the elimination of the line horse by the two drum donkey that the yarding procedure became completely mechanized. Rather than the line horse plodding back to the next log with the main line, a smaller "haulback" line was taken from the second drum and strung through a series of blocks to a tail block at the end of the setting, then back to the donkey where it was attached to the end of the mainline. Initially this haulback line was reeled in on a spool on the end of the hauling drum, from which a spooltender removed and coiled the line, but the development of a second horizontal drum for the haulback line displaced this spooltender. This innovation accelerated the yarding procedure considerably. Now when the log had been yarded to the machine and unhooked from the mainline the donkey engineer simply reeled in the haulback line, which returned the mainline and rigging to the yarding crew in the woods.[55]

The capacity of the donkey was enhanced still further by the addition of the strawline drum, which greatly reduced the time required to establish the area of operations, or setting. Instead of the crew pulling the haulback line into the woods by hand, running it through the blocks and returning it to the machine, the much lighter strawline was carried out and returned to the donkey where it was attached to the haulback line. The engineer then engaged the strawline drum, reeling in the strawline and taking the haulback line through the blocks around the perimeter of the setting.[56]

After several logs had been yarded from where they lay in the woods to the skidroad by the yarding donkey, they were transported down the skidroad in the traditional manner, by oxen or horse teams. Early in the 1890s, however, the bull donkey or "roader" with a large capacity mainline drum was developed.[57] Pine's Patent Bull Donkey was introduced in California in 1893. This double horizontal drum machine was capable of handling six thousand feet of three-quarter inch cable on its main drum, and was intended to be used as a roader in conjunction with the Dolbeer. After the Dolbeer had yarded several logs to the skidroad, they were assembled into turns and roaded down V-shaped fore-and-aft skidroads by the roader, which was situated beside the logging railroad.[58] Some operations worked skidroads of over four miles in length, with four or five roaders stationed along its length. The logs might be assembled into turns on the skidroad by an intermediate "swing" donkey placed between the yarder and the first roader. Frank Hobi provides the following description of his father's three donkey operation near Willapa Harbor in Washington about 1905:

> In operation, the yarding donkey would first haul the logs from a fan shaped area in front of the machine. A choker, some 30 feet long, was placed around the end of the log. There was a hook on one end of the choker and an eye on the other end. After the choker was attached, the "ButtHook" on the end of the mainline was hooked into the eye of the choker and the log snaked to the nose of the yarder sled. From there the swing donkey took charge of the log, the choker was unhooked from the yarder mainline and attached to the Butt Hook of the swing donkey mainline. The swing donkey was located parallel, and a short distance from the end, of the skidroad. As each log was pulled to the nose of the swing donkey it automatically entered

> on to the skidroad . . . As each log entered the skidroad it would push the previous log down the skidroad one log length. After 6 or 8 logs were thus made up into a "turn" the mainline of the road donkey was attached with a wire cable strap to the rear end of the last log which pushed the other logs ahead of it down the skidroad past the road donkey and into the water.[59]

The introduction of steam power and the development of more sophisticated logging donkeys had a significant impact on the nature of work on the yarding crew, but did not revolutionize the productive process. The pace of production was still dependent upon the speed with which logs could be yarded from where they lay in the woods to the head of the skidroad, and in this procedure technological control remained negligible. Operators continued to be dependent upon the members of the yarding crew to cope with a productive setting which was anything but factory-like.

Log preparation, involving sniping and barking, was still required to facilitate the log's passage along the ground, and swampers continued to clear brush and debris from the area between the log and the skidroad. When the haulback had returned the main line and rigging to the woods, the chokermen looped the choker around the log and hooked it to the butt rigging which linked the mainline and haulback. After the chokermen were in the clear the hooktender signalled to a crew member who relayed the signal to the donkey engineer, who engaged the hauling drum, reeling in the log. Initially these signals were relayed with flags, later by the "whistle-punk," usually the youngest and most inexperienced member of the crew, who operated an electrically controlled steam whistle.

It is when the passage of the log is examined that the limitations inherent in ground lead yarding become evident. Peter J. Rutledge, who began logging in 1889, recalled that the limited power supplied by the early donkeys necessitated considerable rigging to increase pulling power. The rigging crew was often required to set six, sometimes eight blocks to move a log.[60] But more powerful donkeys did not provide a solution to the discontinuity of ground lead yarding. When the log approached the blocks through which the mainline ran, yarding was halted while the chaser unhooked the chokers, took them outside of the block and reattached them to the mainline, allowing the log to pass. Vertical spools fastened to stumps, called stump rollers, were later used to guide the mainline in the place of some of the blocks.[61] But in either case, hang-ups were frequent as the log was being yarded in, requiring the chaser to make frequent changes in choker holds to roll the log away from obstructions.[62] R. V. Stuart described ground-lead yarding as "the most frustrating and irritating business that you could imagine." Stuart went on to recall:

> The turmoil of getting these logs out was terrible, and remember that the stumps were still cut six, eight, or ten feet high. Think of dragging the logs over the ground through all that to where they were to be picked up at the road or on salt water . . . The yarder would haul a log . . . some 1,500 feet if it had room to do it, but the stumps were so thick on the ground that it probably wouldn't haul it more than fifty feet on the first lap, then they had to change the choker and go another fifty feet. There was a lot of jumping back and forward. It's difficult to convey all the frustration of that day.[63]

Decisions concerning the use of block and tackle to increase pulling power and the placing of blocks to manoeuver the log around stumps rested with the hooktender. "Upon his alertness and ability to keep the logs moving without loss of time," wrote one observer, "depends largely the profit in logging."[64]

In short, the operators lacked the stable productive setting characterized by the modern factory, in which the pace and therefore the control of work is largely set by the technological structure of the workplace. Output was ultimately dependent upon the ability of the hooktender and other members of the yarding crew to evaluate a myriad of different situations and decide upon the appropriate course of action. The yarding of each log continued to represent an individual problem requiring judgment, physical dexterity and experience.

Although the introduction of steam power did not revolutionalize the production process, the implications of mechanization were immense. Once the suitability of steam-powered donkeys was proven, and the expansion of the logging industry had created a large, permanent market for the products of machinery manufacturers, a relationship was established between the engineering staffs of these concerns and coastal logging operators. The pace of technological innovation would henceforth be stepped up, the result of what Francis Frink of the Washington Iron Works termed a "sharing of ideas" among operators, superintendents, master mechanics, and the machinery manufacturers, who served as the medium through which developments in science and technology were brought into contact with the specific concerns of the industry.[65] Industry slumps proved to be especially productive of innovations, as operators confronted with lower selling prices sought new ways to reduce operating costs, and engineering staffs had the time to devote to research and development.[66]

The concern shared by the operators and machinery manufacturers was to increase productivity at lower costs per unit of production. During the period when ground-lead logging was the predominant method of exploitation this goal was pursued through the development of more powerful compound geared donkeys which eliminated the necessity for the setting and changing of blocks to manoeuver the log around minor obstructions.[67] Power was also enhanced by increasing the cylinder size of the engines from seven to nine inches, and by 1906 the Willamette Iron and Steel Works had developed their "Mogul" yarder which featured cylinders eleven inches in diameter.[68]

Ground-lead logging dictated the sacrifice of speed for power, but machinery manufacturers attempted to satisfy demands for faster yarding by increasing the diameters on the yarding and haulback drums. Slow line speeds meant that "a large and expensive crew are not required to put forth their best efforts to keep the engine busy."[69] Increasing the size of haulback drums accelerated the speed at which the rigging was returned to the woods, reducing unproductive labour time, thus keeping "the yarding crew constantly on the jump."[70] By 1911 haulback line speeds had reportedly reached 450 feet per minute on some machines, and H. S. Turney of the Smith and Watson Iron Works in Portland had developed plans for a two speed yarder which was claimed to be capable of hauling a log in high gear at that same speed.[71]

The mechanization of yarding did result in a subtle redistribution of control over the logging operation. Whereas the teamster had been the most highly paid member of the logging crew, his replacement the donkey engineer possessed less crucial skills, exerted less control over the yarding procedure and consequently had less earning power. Teamsters were paid $90.00 per month in British Columbia camps in 1908, donkey engineers only $75.00.[72] In fully mechanized camps the donkey engineer earned less than the hooktender, who replaced the teamster as the most highly-paid logger.[73] The donkey engineer was far from an unskilled worker. Experience and considerable judgment were attributes of a good engineer, but the power for the logging operation was now supplied, not by an individual whose ability to extract effort from a team was based upon rare skills and a special rapport, but by a machine operator moving a lever upon command. A degree of control had passed from the mind and hand of human labour power to the machine, and thus to timber capital.

Mechanization also carried with it the potential for increased managerial control through a more well-defined division of labour. John A. Van Orsdel of the Portland Lumber Company, a frequent contributor to the Pacific Logging Congress and a future instructor in logging engineering at the Oregon Agricultural College informed the audience at the 1913 Congress of the importance of large operations having a spare yarding machine and rig-up crew to establish the productive system in advance, so that when the yarding crew finished logging one setting they could move and continue production with a minimum of lost time. In this way continuous production was possible, and as an added benefit the workers employed on the rig-up crew were "not such high-priced labour" as those on the yarding crew.[74] The same year Charles Koelshe of the International Timber Company at Campbell River advocated his company's practice of having the timber felled and bucked around an extra machine and rigging at all times so that on moving days or in the case of high winds or breakdowns yarding would not be seriously interrupted.[75]

For the loggers on the yarding crew, mechanization would bring the first experience of machine pacing. The power of the large yarding donkeys made some of the rigging skills used by the yarding crew to increase power and avoid obstructions obsolete,[76] and higher line speeds meant that the productive system itself would dictate to an increasing extent the rate at which loggers performed their tasks. But even the most powerful donkey capable of the highest line speeds did not free the operators from their dependence upon the conceptual and physical skills of the hooktender and yarding crew to negotiate each log to the landing in an environment marked by instability and uncertainty. Steam powered ground-lead yarding had embodied within it the potential for technological control which would be realized only with the adoption of aerial methods. The technological and managerial innovations described here undoubtedly effected an intensification of the labour process, but failed to bring about a radical change in workplace relations.

The most severe impact of machine yarding on the working lives of coastal loggers was the danger which accompanied the arrival of the donkey and the wire rope which stretched between it and the log. The initial step in mechanization failed to subordinate loggers to the demands of the productive apparatus, but it unquestionably brought a new level of human destruction to the western woods. Evidence of the reaction of loggers to the introduction of steam power is scarce, but Francis Frink, of the Washington Iron Works admitted that mechanization was "resented in some camps."[77] One Humboldt county operator recalled in 1921 that when he purchased two Washington Iron Works donkeys for his operation in 1906, he was forced to obtain crews from another region because of the refusal of local loggers to work with the machines. Similarly, loggers at one Vancouver Island camp walked off the job when steam power was introduced, necessitating the importation of other crews to continue the operation.[78] Those who were unwilling to accept the new technology probably shifted to smaller camps which continued to use animal power, or moved out of the industry, although transferring skills which were specific to the logging industry in an economy which provided few alternatives would not have been easy. As the industry moved overwhelmingly to steam power after the turn of the century most loggers would have had little choice but to accept the changes which had been thrust upon them.

Overhead Logging

The aerial yarding methods which came into use in the coastal woods after the turn of the century fall into two main categories:

overhead systems, involving the suspension of a main cable between two spar trees; and high lead yarding, featuring a single spar tree. Overhead methods were of three main types, skidder, tight line, and slack line systems. Although each differed somewhat in terms of equipment and operation, this study will devote little attention to the differences, focusing instead on the essential principle each embodied--the yarding of logs while partially or completely suspended in the air.

Overhead yarding was first employed in Michigan in 1886, and by 1893 the Lidgerwood skidder system was in widespread use in both the midwest and the cypress swamps of the southern states.[79] Although the Bridal Veil Lumber Company in Oregon used an overhead system in 1901 to transport logs after they had already been ground yarded,[80] the first overhead yarding done in the northwest was by the Lamb Lumber Company at Hoquiam in 1902, and the Kerry Mill Company at Kerriston Washington, who brought the first Lidgerwood skidder to the coastal region during the same year.[81] The Lidgerwood Company established an office in Seattle in 1903, and shortly thereafter obtained the patents to Lamb's cableway system.[82] By 1912 several prominent coastal lumber and logging companies had adopted the Lidgerwood skidder, including the Canadian Western Lumber Company on Vancouver Island, the Merrill and Ring Lumber Company, the English Lumber Company, the Dempsey Lumber Company and the St. Paul and Tacoma Lumber Company in Washington, and the Benson Lumber Company in Oregon. The early Lidgerwoods brought to the northwest were machines developed for the smaller eastern timber, but by 1912 the company was advertising a tree rigged skidder system built specifically for coastal conditions.[83]

The Lidgerwood skidder system featured a cable suspended between two spar trees along which ran a carriage that was connected to the hauling drum on the engine by a line running through a block suspended in the head spar. (See Figure 1, Appendix.) The haulback line ran from the engine through a block on the tail spar, then to the carriage, and was used to haul the carriage back to the woods. A third line, called the in-haul line ran from the engine through a block on the head spar, through the carriage, then to the rigging crew in the woods. In operation, the haulback pulled the carriage to the rigging crew, where a sufficient amount of slack was paid out on the in-haul line to allow it to be hooked to the chokers, which had been looped around the logs. The skidding line was then reeled in by the engineer, raising the ends of the logs off the ground. The brake on the haulback was then released, and the main hauling drum engaged, drawing in the carriage and logs along the main cable to the landing. By 1914 the Lidgerwood was the most widely used overhead system in the northwest, and by 1926, after the expiration of the Lidgerwood patents, the Willamette Iron and Steel Works and the Washington Iron Works had developed their own skidder systems.[84]

Coastal operators who were anxious to explore the advantages of overhead logging prior to this time were not restricted to purchasing the Lidgerwood system, and the Lidgerwood Company appears to have watched closely for any patent infringements.[85] A few developed their own systems, first adapting existing equipment to overhead methods, then working in conjunction with northwestern machinery manufacturers in the design of special engines and rigging. Two of the most prevalent were the MacFarlane slack line system designed by C. E. MacFarlane in 1905, and the North Bend tight line system, developed by R. W. Vinnedge and F. M. Shaw of the North Bend Lumber Company in 1912. In 1915 the founders of these systems organized the Aerial Tramway Company to market the patented systems, providing the industry with less costly alternatives to the Lidgerwood, which in 1914 sold complete for about $30,000.00. The cost of a complete MacFarlane system at the time was about $11,500.00, that of the North Bend, about $7,650.00.[86]

The distinguishing feature of the slack line system was that the skyline, which remained stationary in the skidder, North Bend and other tight line systems, was lowered and raised for each turn of logs. (See Figure 2, Appendix.) The MacFarlane consisted of a sky line suspended between the head and tail spars along which a carriage travelled. The yarding line ran from the engine through a block on the head spar to the front end of the carriage. The haulback line ran from the haulback drum through a series of blocks to a block on the tail tree, then was attached to the rear of the carriage. In operation, the haulback took the carriage to the rigging crew. The skyline was then slacked off, lowering the carriage to the ground where the chokermen looped chokers around the logs and attached them to the carriage. The skyline was then tightened, raising the carriage and logs above obstructions. While powerful brakes on the engines held the skyline taut, the engineer engaged the hauling drum, pulling the logs to the landing where they were unhooked. By 1914 the MacFarlane system was being used by several coastal concerns, including the Powell River Company in British Columbia, the Mason County Logging Company, the Skagit Mill Company and the Manley-Moore Lumber Company in Washington, and the Smith-Powers Logging Company at Marshfield, Oregon.[87]

A still less expensive alternative to ground yarding was the high lead system, in which the main line was passed through a block of a single spar tree, then to a block fastened to a stump at the far end of the setting. The haulback line ran from the engine through a series of blocks around the end of the setting where it was attached to the main line. For a distance of about six hundred feet the high lead lifted the front end of one or more logs, allowing them to pass over obstructions. (See Figure 3, Appendix.) The high lead yarding crew consisted of the hooktender, who retained overall supervision over the yarding operation, rigging slinger, chokermen and whistle punk. The chokermen, under the direct supervision of the rigging slinger, looped the chokers around the log. The rigging slinger then hooked the chokers to the butt rigging on the main line, and, when the chokermen were in the clear, signalled to the whistle punk, who blew the signals to the donkey engineer to haul in the log.

The origin of high lead yarding is unclear. When H. B. Gardner opened up a tract of timber at Discovery Bay, British Columbia in 1906, in addition to investigating the methods in use in the northwest, he travelled through the southern lumbering regions to study the methods in use in that area. There he was impressed with the "tree rig skidder," of which he said in 1916, "was nothing more than what we call the high lead."[88] Gardner purchased the engine and rigging and had it shipped to Discovery Bay where it was put into service. W. S. Taylor also asserted that the system brought west by Gardner was a high lead system.[89] Other evidence suggests that high lead logging was a coastal innovation, and that Gardner was probably referring to the Lidgerwood skidder described earlier. James O'Hearne argued at the 1916 Logging Congress that the high lead had been used on the coast for several years to overcome environmental obstacles, "such as putting a bull block on a gin pole, or hanging it in a tree to get logs up a rock bluff."[90] O'Hearne went on to say that the high lead had been used by two camps about ten years ago "in practically the same form as they are now" but that the method had become widespread only in the last two years. Josiah Shull, the author of a thesis in forestry at the University of Washington in 1926 on overhead logging on the Pacific coast also refers to high lead logging as a "western product."[91] At any rate, George Cornwall was able to declare at the 1915 Pacific Logging Congress that high lead yarding was in "very general use" and that overhead logging was becoming increasingly prevalent.[92] Although ground-lead yarding remained popular among smaller concerns, it seems clear that either or both of the aerial methods were being used by a majority of the large coastal operations at this time.

Why did the industry move so overwhelmingly to aerial methods? The traditional explanation is that the increasingly rough terrain encountered as logging progressed inland away from the coastline and river valleys forced operators to adopt the overhead or high lead systems. Popular historians, academics, and students have unfailingly accepted the environmental imperative to explain the rapid transition to aerial yarding.[93] There is evidence to support this conclusion. Industry spokesmen and operators themselves constantly complained about the higher production costs they were facing and many spoke of aerial logging as a solution to the problem of logging on difficult terrain. Some went so far as to indicate that on level ground overhead methods had little or no advantage over ground yarding.[94]

The Merrill and Ring Lumber Company was probably the second Washington firm to purchase a Lidgerwood skidder. The company's logging superintendent went to Kerriston to observe the operation of Kerry Mill Company's skidder in October of 1908.[95] His report was favourable, and in November the company obtained its first Lidgerwood skidder.[96] By August of 1909 Tiff Jerome, the company's secretary, was able to report that the skidder was a "huge success."[97] A year later the company ordered a second skidder, and in 1911 a third was purchased. According to the accepted wisdom, we would expect to find Merrill and Ring executives and other operators explaining their adoption of these systems as a response to more difficult topographic conditions. But when the conditions under which the first overhead systems were implemented are examined, we discover no clear relationship between environmental factors and their use. When R. D. Merrill presented a paper on the operations of the Lidgerwoods at the 1911 Pacific Logging

Congress, he reported that they were being used on "level ground" and that "only experience would show how well it would do on rougher conditions."[98] As late as 1916 Jerome replied to the inquiry of another lumber company that the three skidders were still being used on "comparatively level ground," showing that Merrill's 1911 report did not refer to an initial trial period.[99]

Similarly, when Charles Stimson of the Ballard Lumber Company described the operation of the firm's Lidgerwood skidder in an article for the Timberman in 1909, he wrote that the system was being used on "comparatively level ground."[100] H. B. Gardner supported these conclusions at the 1916 Pacific Logging Congress, arguing that the Lidgerwood was best adopted in medium sized timber, "where the ground is not too rough," and that while the system was effective on level ground or up-hill hauls, it was not well suited to down-hill yarding, "or on rough ground."[101] When R. W. Vinnedge introduced his North Bend system at the 1913 Congress he bemoaned the passing of the easy logging shows, but when he referred to the terrain at his operation he described it as "slightly broken, but on the average good."[102] The sole exception to this pattern was the example of the English Lumber Company, which applied their Lidgerwood skidder to "very rough, steep ground."[103]

Operators and managers who adopted the high lead system made similar statements about the topographic conditions at their operations. During the 1916 Logging Congress, devoted to the discussion of high-lead yarding, Ronald MacDonald of the Cherry Valley Timber Company reported that ground conditions were good at their camp.[104] F. C. Riley of the Bloedel-Donovan Lumber Mills explained that the system was satisfactory on "reasonably level ground" or on up-hill hauls.[105] James O'Hearne, manager of the English Lumber Company echoed the tenor of these remarks, claiming that the high lead was suitable for medium sized timber, "standing on the level or where it can be yarded up a slight incline."[106]

On the basis of these statements there is little direct evidence to support the contention that rougher ground prompted the initial transition to aerial yarding. The operators and logging superintendents who reported on the early systems referred to topographic conditions which in their own minds, were better than the average.

When operators and superintendents turned to explanations of the advantages of aerial logging, they referred instead to the inherent superiority of the systems over ground yarding, emphasizing increased productivity, the elimination of positions on the yarding crew and a reduction in the degree of control exercised by skilled workers over the pace of production. Output was expanded because of the higher line speeds aerial logging permitted, and the fact that more than one log could be yarded at a time. Merrill boasted that the Lidgerwood moved logs through the air at two to three times the speed which ground yarding permitted.[107] The return of the rigging to the woods was also accelerated. The haulback speeds on Lamb's early cableway system were claimed to be twice that of the ground yarder, three times that of the line horse.[108]

Speeds were increased still further by the development of faster multi-gear engines. Ground yarding had required great power, and because of the tendency for the log to stop while the gear change was being made, manufacturers had largely been frustrated in their efforts to design a practical two-speed engine. Now that logs were being yarded through the air the instantaneous change of gears was possible, and in 1917 the Willamette Iron and Steel Works began producing engines which supplied power for the initial pull, then allowed a gear change for increased speed as the log was being pulled in.[109] By the middle of the 1920s hauling speeds of the most powerful skidders had reportedly reached one thousand feet per minute.[110]

Direct labour costs on the yarding crew were reduced as swampers, the chaser, and snipers and barkers were no longer necessary. These men were now on an "eternal vacation."[111] Because aerial systems permitted greater yarding distances, railroad construction costs were reduced, as were landing construction costs. In addition, cable and rigging lasted longer, as the frequent jarring which had occurred when logs being yarded along the ground hit obstructions was minimized.

The combination of these factors resulted in an expansion of productivity at reduced unit costs. Merrill reported that over a two year period his company's Lidgerwoods had yarded and loaded logs at two-thirds of the cost of logging with the ground yarders being used concurrently.[112] Other operators who compared the logging costs of the high lead system and ground yarders reported similar results.[113] But these quantitative gains were achieved only through a qualitative increase in the operators' control over the yarding operation. In essence, they took a significant step toward freeing themselves from their reliance upon the ability and initiative of loggers to negotiate each log to the landing. As long as yarding took place in direct contact with coastal terrain, ultimate control over the pace of production had rested with the yarding crew, a condition which was reflected in the discontinuity of the procedure. R. W. Vinnedge made direct reference to this fact at the 1913 Pacific Logging Congress. "In spite of our high powered donkeys," he said,

> we are today zigzagging around among the stumps just as the bull puncher did a generation ago. The stumps were his great problem then, and so they are ours today.

The overhead cableway was a "solution to the yarding problem" because of the elimination of the

> necessity for an endless shifting of chokers and pulling of line to permit perhaps one, and seldom over two logs to bore a tortuous path through acres of stumps and debris.

Instead, for a higher initial cost, Vinnedge's North Bend Lumber Company was able to transport up to six logs to the landing at a time, "with seldom a stop after the go-ahead whistle."[114]

Frank Lamb phrased the description of his system in terms of the intensification of the transformation of labour power into work which the overhead method allowed. Lamb explained that an experienced ground-yarding crew working on level terrain would do well to bring in an average of thirty logs per day, but that the time actually consumed in yarding each log and returning the rigging to the woods was not over eight minutes per log, constituting an actual yarding time of only four hours per day. But with the overhead method no time was lost preparing yarding roads and swamping, and "the time consumed in placing and throwing lines in and out of lead blocks and in blocking logs away from obstructions is devoted to hauling logs."[115]

The advantages of aerial yarding were not limited to the elimination of workers and the intensification of the labour process. Machinery manufacturers and operators pointed to the reduction in the skills required by members of the yarding crew. According to Sid Smith, a veteran British Columbia logger, the high lead system "took away the necessity of having good chokermen and rigging slingers."[116] Lamb pointed out that with his system only two men, the engineer and hooktender, were "high priced men." The line horseman, chaser and riggingman were replaced by "cheaper men."[117] Another writer declared that the adoption of overhead methods meant a dimunition in the reliance upon the skilled hooktender, "upon whose caprices hangs the day's output."[118] That this was in fact the case is made clear by the recollection of Smith, who was the logging superintendent at the Bloedel, Stewart and Welch operation in British Columbia when the company made the transition to high-lead logging. Smith noted that the company fired their veteran hooktenders because of their resistance to the transition to aerial yarding.[119] The new method encroached upon the hooktender's skill and authority as the individual primarily responsible for manipulating logs to the landing.

To return to the analogy of the factory, aerial yarding can be compared to the technological control of the modern assembly line. Operators achieved a routinization and regimentation of the yarding procedure which the limitations inherent in ground yarding had denied them. Control over the direction and pace of work began to shift from the workers to the productive system itself.

The efficiencies which aerial logging provided were not acquired without the creation of one new skilled position--that of the high rigger. It was the rigger's job to climb the chosen spar trees, taking the limbs off on the way up, to cut the top of the tree off at a height of seventy-five to two hundred feet, and with the use of a line from the engine, raise the blocks and cables to the top of the tree. He also stabilized the tree by fastening guy lines to it which were attached to stumps surrounding the spar tree.

More than any other figure it is the image of the high rigger standing atop a 150 foot Douglas Fir which dominates the perception of work in the coastal logging industry. He personifies the special skills, courage and rugged individualism which are associated with logging. This image is quite valid, for the high rigger's duties demanded all of these qualities and more. The job was spectacular and dangerous, earning the rigger a wage and a position on the occupational hierarchy comparable with that of the hooktender.[120] The image is not without its irony, however, for it was the high rigger's function to establish and maintain the harvesting system which ensured logging operators unprecedented control over the workers involved in the logging operation itself. Conceptualized in this way the high rigger is not a production worker in the same sense as loggers on the yarding crew, but occupies a position somewhere between an engineer and a skilled maintenance worker, converting the designs of operators and engineers into reality. Companies were eager to add another skilled worker to their payroll because the benefits--higher output and less reliance on the skills and initiative of loggers of the yarding crew--far outweighed the expense.

But the high rigger was not immune from the social and economic pressures which had created the necessity for the position. Firms with large enough holdings to ensure long-term existence began exploring the suitability of the Lidgerwood portable steel-spar skidder, which had been in use in the midwestern and southern lumbering regions for some time. Rigging ahead was cost-efficient, but required additional donkeys, rigging, and a special crew headed by the high rigger. One advantage of the steel-spar skidder mounted on a railroad car was the rapidity with which it could be moved, eliminating the expense of extra equipment and workers. Because blocks and lines remained fixed to the spar which was lowered for moving, only the sky-line and guy-lines had to be reset and the tower raised when the machine arrived at a new setting.

R. D. Merrill was probably one of the first northwestern operators to express an interest in the steel-spar skidder. He pointed out to Robert Polson in 1913 that the machine could be moved in a three to four hour period, instead of the day and one-half which was required to move the tree-rig Lidgerwoods the company was then using.[121] Late that year he sent the firm's logging superintendent to Minnesota and Louisiana to watch the machines at work. The superintendent was "very favorably impressed" with their performance, but for unknown reasons the company did not proceed with the purchase immediately.[122] In 1917 it was decided instead to speed up the moving procedure by hiring a rig-up crew to set up the systems in advance.[123].

The Lidgerwood company began advertising the steel-spar skidder for coastal use in 1914, and by the mid-1920s they were being used by several firms and were a frequent topic of discussion at the Pacific Logging Congress.[124] The machines, which cost approximately $50,000.00 in 1923, were capable of hauling speeds of up to one thousand feet per minute, and had an advertised daily maximum output of 250,000 feet.[125]

The steel-spar skidder represented an extension of the control inherent in aerial logging, freeing companies from the necessity of locating railroads and logging tracts in accordance with the position of natural spar trees, or the expense of raising them at appropriate points. This enabled operators like F. R. Olin to devise logging plans with "only the natural contour of the section to be logged" in mind, setting the skidder at points "to which the timber will come out easiest."[126] With the application of the portable steel-spar skidder to coastal logging the analogy of the factory becomes sharper. Production was increasingly a case of purchasing and repeatedly establishing complete harvesting systems which gave firms unprecedented control over their operations.

The remaining major technological change effected by operators during the period under study was the substitution of oil for wood as a fuel for steam donkeys, and the replacement of steam power by diesel and gasoline powered internal combustion engines during the late 1920s. The development of electrical logging equipment was also undertaken, most notably by the giant Weyerhaeuser and Long-Bell operations in Washington.

Logging and lumber companies had three compelling reasons to change to oil-fired steam donkeys: first and most important, labour costs were reduced by the elimination of wood buckers and firemen; second, because these men invariably chose valuable clear logs for fuel that were easier to buck and split than the coarse, knotting logs preferred by foremen, saleable timber was saved; and third, oil produced fewer sparks than wood, reducing the risk of forest fires.

The substitution of oil for wood as a fuel for donkeys was discussed at the 1910 Pacific Logging Congress, where a demonstration was given, and by 1912 the Loggers Oil Equipment Company was installing conversion units which enabled wood-burning donkeys to use oil.[127] The Merrill and Ring Lumber Company investigated the possibility of converting their Lidgerwood skidders to oil early in 1912, when W. J. Chisholm, the firm's logging superintendent, travelled to Portland to inspect an oil-burning donkey.[128] By March of that year the company had converted two of the skidders, and in July, Tiff Jerome was able to report that their performance was "very satisfactory," in that "we have been able to do away with a fireman and woodbucker for each machine," and the merchantable logs which had previously been used for fuel could now be sold.[129] The company determined that the cost of oil almost equalled the labour costs involved in bucking logs and firing the skidders, but that they saved the value of the timber, which amounted to approximately one thousand board feet per machine per day.[130] Reports given by several firms at the Pacific Logging Congress between 1910 and 1920 reveal significant cost reductions through the elimination of wood buckers and firemen, and leave little doubt that this was the primary motivation for the adoption of oil burning donkeys.[131]

Identical reasons prevailed for the replacement of steam engines by diesel and gasoline engines. Although the prospect of a gasoline logging engine was first discussed at the 1917 Logging congress, it was not until 1928 that gasoline and diesel powered donkeys began to make a significant impact.[132] Two operations which converted to diesel in 1928 reported fuel cost reductions of 97 percent and 96 percent. Thirty-one percent of the reduction in the first case, and 41 percent in the second were due to the elimination of firemen and wood buckers.[133]

Large logging firms which were unable to take advantage of increases in the size, speed and power of cable yarding equipment, the development of new fuels, and the introduction of power shovels for railroad construction work enjoyed sharp reductions in labour requirements. One study of seventeen large Washington camps over the 1920-1929 period indicated that the number of man-hours required to produce one thousand board feet may have declined by as much as 32 per-cent.[134]

How did the workers other than hooktenders respond to these changes? Fragmentary evidence suggests a pattern of individual resistance to the introduction of aerial logging. The high speeds at which logs and rigging now travelled meant that loggers had to work harder, but more seriously, aerial methods brought with them a striking increase in the dangers associated with logging.[135] Loggers at the Merrill and Ring camp at Mukilteo expressed their resistance by quitting, presumably to work at ground-lead operations. Although the company was very satisfied with the skidder obtained in 1909, they immediately experienced "trouble in keeping a crew."[136] Jerome informed T. D. Merrill that Finnish loggers were the most adept at operating the new system, but it was "almost impossible to keep Finns." The company temporarily changed its employment policy, hiring Finns for railroad construction work so that a supply of replacements would be readily available for work on the skidder. This policy was not a success, however, and shortly thereafter Jerome reported that the logging superintendent was "working in some white men on the skidder," in hopes of eliminating the Finnish loggers.[137]

The Merrill and Ring experience was not an isolated one. The manager of the English Lumber Company explained at the 1910 Pacific Logging congress that the only negative aspect of the firm's new skidder was "the aversion the men felt to working around the machine."[138]

Loggers at the Weyerhaeuser Timber Company's Yacolt operation had a similar reaction to the introduction of the high lead system about 1915.[139]

There is no evidence to suggest that resistance to a dangerous and oppressive technology hindered its widespread adoption. The initial reluctance to make the change to aerial logging expressed by some operators was probably due to the increased expense for wire rope and new donkeys, and an uncertainty that the system would prove efficient.[140] Although the individual and collective resistance of loggers to the conditions of their employment would play an important part in structuring hours of work and living conditions, they had no apparent success in resisting the instruments of production which determined the objective features of their work. Certainly by 1920 aerial logging was the predominant method of exploitation among the region's largest firms.

Conclusions

In a period of forty-five years coastal logging had been transformed from a production process based on animal power to one which was based, to a large degree, in science. Huge internal combustion engines had begun to take the place of steam power, which had earlier replaced oxen and horses. Wire rope of great strength and flexibility had displaced chains and manila rope. The arduous procedure of yarding logs along the ground had been superceded by the rapid transportation of logs while partially or completely suspended in the air. As speed had assumed priority over power, rigging had become lighter and more manoeuvrable. Portable steel-spar skidders gave some operators unprecedented mobility and freedom from environmental constraints.

Before going on to offer some conclusions on the implications of these changes for operators and loggers, a few comments on the process of technological change itself are appropriate. Throughout the period under study operators, their managers and even workers initiated the design of new equipment and methods, and developed techniques in response to particular situations. But with the expansion of the industry in the late nineteenth and early twentieth centuries the character of technological activity underwent a crucial transformation, as the industry attracted manufacturers to the production of logging equipment. An informal alliance between logging operators, managers, and the university trained engineering staffs of firms producing donkey engines, wire rope and other equipment was formed, bringing the needs of lumber capital into touch with the latest developments in metallurgy and mechanical engineering. As M. H. Dickenson of the Lidgerwood Manufacturing Company put it in 1922, "all the inventions of the Lidgerwood company came from the loggers indirectly. They told us what to do and we got the engineers to do it."[141] In effect, innovation itself became a systematic productive activity, with research and development facilitated by frequent contact between logging operators, managers and equipment manufacturers and their representatives who travelled through logging areas to gain an awareness of the needs of the industry. F. B. Mallory, a prominent manufacturer of logging blocks and related equipment made such a journey through the Puget Sound region in 1913 in response to the increasing use of overhead methods, after which he designed a new line of automatic lubricating skyline blocks.[142]

Because logging operations took place in such isolation from one another, owners tried to keep abreast of developments in equipment and methods by visiting other camps in the northwest, or prepared letters of introduction for superintendents, foremen and master mechanics to do the same.[143] As previously indicated, a few of the most aggressive operators such as H. B. Gardner, R. D. Merrill and C. T. Murray of the West Fork Logging Company did not restrict this research to the coastal region, but travelled themselves or sent managers to the south and mid-west to investigate the logging systems in use in those regions. Most significantly, in 1909 the first Pacific Logging Congress was held, providing owners, managers and equipment manufacturers with an annual forum for the discussion of technological and managerial matters. Although the industry continued to function in geographical isolation, by the end of the first decade of the twentieth century it was entering the mainstream of North American industrial capitalism in terms of its approach to technological development.

To conclude, it was the vision of the factory, and the control over workers which that setting offered which drove the process of technological change in west coast logging between 1885 and 1930. Changes in the accessibility of the resource certainly favoured the adoption of aerial methods, and as canyons and ravines were encountered their use became mandatory. But those firms which were responsible for the appearance of aerial systems in the northwest implemented them because of their inherent superiority over ground yarding, a superiority demonstrated by the most important criterion of capitalist production--increased productivity at lower costs. But the terms "output" and "productivity" reveal nothing about the human activity of production, the relations which shape it and the kinds of work which compose it. It is only when the labour process itself is examined that the fundamental and constant antagonism between capitalists and workers which characterize capitalist relations of production moves to the forefront of the analysis. From this perspective the study of work raises the issues of social power and control. Paralleling the transformation of the production process was a subtle redistribution of power in the relationship between operators and loggers. Operators pursued control over production, and thus power over the loggers in their employ as a means of diminishing the amount, value and variability of the labour power which they purchased, thus enhancing the profitability of their enterprises. Labour power, like any other commodity, was to be obtained as cheaply as possible and pushed for all it was worth.

Of course, the relations between operators and loggers were structured by a social context which included the competitive relations between capitalists. Individual firms had many factors to weigh when considering the purchase of expensive aerial logging systems, but once the superiority of these methods was established, the pressures of competition compelled large firms to adopt them.

It must be emphasized that while aerial logging represented a real advance in technological control, the subordination of the logger to the productive apparatus remained far from complete. Higher speeds meant that loggers were forced to work harder, but the operation continued to be discontinuous, with the pace of production dependent to a considerable degree upon the ability of loggers to perform crucial tasks, thereby linking the various stages of the process into a smooth flow. Moreover, aerial systems did allow tracts to be profitably logged which would have defied ground yarding, and as these were encountered the difficulty of negotiating difficult terrain and setting chokers on steep side hills dictated a continued reliance upon the skills of loggers on the yarding crew. "The human element," R. W. Vinnedge observed in 1922, was still very much a part of aerial yarding, especially in the high lead and overhead systems which did not provide adequate "control of [the] log." The output of even the most advanced skidder systems which supplied the highest amount of log control hinged upon the physical dexterity, initiative, and "know how" of the loggers involved. "If not for the ever-present human element to contend with," Vinnedge complained, "the skidder system would yard as many logs on rough as smooth ground."[144] Vinnedge and other operators had discovered that the aerial logging operation failed to provide the technological control which would have reduced loggers to the level of unskilled labour.

In addition, although the new technological structure of the industry diminished the skill requirements of individual occupations, logging crews as a collective still exerted real control over production.

Aerial yarding systems were capable of high speeds and greatly expanded output, but required a crew working in harmony to achieve their full potential. Furthermore, because of the expense of these systems, anything less than operation at close to maximum capacity was extremely costly to operators. The technology which was making the skills of individual loggers less crucial put a high premium on the ability of a crew to work together as an effective unit. Logging, Frank Lamb observed in 1917, "calls for a high order of teamwork" and the constantly shifting work force of the coastal industry inevitably led to "disorganization and loss of efficiency."[145] R. D. Merrill was also aware of the improved efficiency which resulted from having "men in the crew that are accustomed to working together."[146] The importance of teamwork was illustrated at one Weyerhaeuser camp. When a curtailment of production resulted in the concentration of the best loggers into a few skidder crews, two months was required for this group of "top-notch" individuals to begin logging as an efficient unit.[147]

Nevertheless, the impact of technological change on the skills of loggers, and thus the degree of control they exerted over the production process is clear, if difficult to quantify. Certainly each log represented less of a problem to be "solved" by the hooktender and members of the yarding crew. By 1930 the harvesting system itself, a product of the collaboration of operators, managers and mechanical engineers, had rendered unnecessary many of the conceptual and physical skills which had formerly been the crucial ingredient in any logging operation. High-lead logging "isn't exactly an assembly line," wrote

Stewart Holbrook, "but it's all routine."[148]

In addition, the frequent hang-ups which had previously resulted in a temporary redistribution of positions and an opportunity to acquire new skills were reduced. Operators also turned increasingly to less skilled rig-up crews to establish machinery and rigging in advance, so that the logging crew would arrive at a new setting with the system already in place, with the result that loggers occupied well-defined positions in an increasingly rigid division of labour. Both the discretionary content and task range of occupations on the yarding crew became more confined. Logging operations had indeed begun to resemble, as Holbrook observed in 1938, "a gigantic factory without a roof."[149]

Footnotes

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[16]R. J. O'Farrell, "The Evolution of Logging--Some Personal Glimpses," University of Washington Forest Club Quarterly 8 (Autumn 1929), p. 10.

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[21]John R. Reavis, "Logging on Puget Sound," Washington Magazine (Sept. 1899), p. 16.

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[96]T. Jerome to T. D. Merrill, November 16, 1908, Box 2, Merrill and Ring Lumber Co. Records, Acc. 726-4.

[97]T. Jerome to Salsich Lumber Co., February 1, 1910, Box 3, Merrill and Ring Lumber Co. Records, Acc. 726-4.

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[101]Gardner, "Ground Skidder or High Lead," p. 13.

[102]R. W. Vinnedge, "A Composite Flying Machine," PPLC (Spokane, 1913), p. 10.

[103]E. G. English, "Cableway Yarding System, Its Efficiency in Difficult Logging Operations," PPLC (Portland, 1910), p. 28.

[104]Ronald MacDonald, "High Lead and Ground Yarding Compared," PPLC (Portland-Grays Harbor, 1916), p. 11.

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[107]Merrill, "Utilization of the Lidgerwood System of Logging," p. 55.

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[111]"The Evolution of Coast Logging," p. 23.

[112]Merrill, "Utilization of the Lidgerwood System of Logging," p. 58.

[113]MacDonald, "High Lead and Ground Yarding Compared," p. 12; Robert Waddell, "Ground Work vs. High Lead Logging systems," Western Lumberman 13 (July 1916), pp. 41-43.

[114]Vinnedge, "A Composite Flying Machine," p. 9.

[115]"The Lamb Cableway System," p. 47.

[116]S. G. Smith, interviewed by C. D. Orchard, Orchard Collection, Public Archives of British Columbia.

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129T. Jerome to Craig Mountain Lumber Co., July 24, 1912, Box 4, Merrill and Ring Lumber Co. Records, Acc. 726-4.

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[138]E. G. English, "Cableway Yarding System, Its Efficiency in Difficult Logging Operations," p. 28.

[139]Alden H. Jones, From Jamestown to Coffin Rock: A History of Weyerhaeuser Operations in Southwest Washington (Weyerhaeuser Co., 1974), p. 12.

[140]Van Orsdel, "Machine Yarding and Loading," p. 44.

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[146]R. D. Merrill to J. R. Benjamin, June 12, 1918, Box 28, Merrill and Ring Lumber Co. Records.

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CHAPTER III

THE EMERGENCE OF THE PROFESSION OF LOGGING ENGINEERING

Introduction

This chapter examines an important aspect of the development of North American industrial capitalism: the emergence of a group of university trained, professional engineers who brought a new level of administrative control over the labour process. During the early twentieth century coastal logging operators responded to the inadequacy of existing management practices by launching an initiative which resulted in the inception and molding of degree programs in logging engineering at western universities. Inspired by the examples of industries which had already been successful in having schools established for the training of engineers, western logging operators used their prominence in the regional economy to demand and receive their own corps of efficiency experts. Like the engineers in other fields, the logging engineers were called into existence to regain managerial control over a production process which had grown in scale and technological complexity.[1]

The creation of a distinct group of logging engineers was rooted in the ideology of scientific management. As Peter Drucker and Braverman have argued, scientific management had a pervasive and lasting impact on American managerial thought.[2] Its manifestation in the logging industry exhibits what Dan Clawson has identified as the essential core of Taylor's program. Taylorism, he writes,

> is based on the skill and training of a group of workers who are separate from production workers, who today are socialized primarily in schools and colleges and not on the shop floor. These people do not themselves produce the goods, but they organize work in such a way that production workers have as little need as possible to use their skill and initiative.[3]

Even though few of the specific elements of scientific management appeared in the logging industry, this does not detract from its powerful influence as an ideology of efficiency based upon the concentration of planning and design work within a small managerial elite.

This chapter has four main objectives, involving the analysis of a complex set of social relationships. Section II explains the origin of the crisis of control which led the operators to forge a relationship with the region's universities. Section III examines the relations between timber capital and university officials and educators in the creation of programs and the development of curriculum. The purpose of Section IV is to describe the functions and work experiences of the engineers, and assess their position in the industrial bureaucracy. The focus here is on the relationship of the engineers to their employers, to other managers, and to the loggers. Finally, some conclusions concerning the impact of the engineers on the division of labour in the industry are offered.

The central argument of the chapter is that the operators were successful in bringing the educational resources of the state to bear on their managerial problems. Although relations between timber capital and educators were often marked by tension, the universities served to reinforce capitalist control over logging operations. Relations between the engineers and their employers were similarly characterized by a conflict rooted in the engineers' desire for a more autonomous role in the determination of policies than operators were willing to grant. Again, this discord did not detract from the essential role of the engineers: to centralize authority and create a sharp division between the mental work performed by owners and top managers and the manual labour carried out by loggers.

The Crisis in Management

Three related elements of industrial capitalist development combined during the latter nineteenth and early twentieth centuries to render earlier managerial structure and practices inadequate. The concentration of holdings into huge timber empires, the advent of railroad log transportation systems, and a consequent expansion in the scale of firms' logging operations were factors in the creation of a managerial crisis which left operators and managers unable to control the conception, planning and execution of their operations.

The primary factor in generating this crisis was the change in the pattern of timber ownership. The small holdings characteristic of the earlier nineteenth century allowed logging plans to be formulated by the operator, superintendent or foreman walking over the ground and perhaps relying on the rough topographic notes made by the cruiser who had estimated the amount and quality of the timber. The setting out of yarding roads, skidroad routes and landing locations was accomplished by the formation of a "mental picture" of the tract and how it could be logged most efficiently.[4] Given their importance in the production of logs it is likely that the most skilled loggers, such as the teamster and hooktender, would have participated in this process. But the ownership of densely timbered tracts featuring thick underbrush, ranging in size anywhere from twenty thousand to one hundred thousand acres made this method of conceptualization impossible.

The adaptation of railroad technology for the final stage of log transportation, a response to the concentration of timber holdings and the depletion of easily accessible timber contiguous to coastal waters and rivers, contributed to the managerial crisis. As skidroads became longer and less effective for transporting large quantities of logs, heavily capitalized firms began in the 1880s to construct logging railroads which offered greater capacity and higher speeds. By 1889 West Shore estimated that there were twenty-two logging railroads in Washington, seven in Oregon, and by 1900 the railroad was the dominant form of major transportation.[5]

During the early period of railroad transportation, operators entrusted the layout of railroads to superintendents, foremen or civil engineers. Often the surveying and location of mainlines was performed by civil engineers hired specifically for that purpose, while foremen were put in charge of spur line location.[6] By the early years of the 1900s, however, operators were expressing dissatisfaction with each of these groups. Civil engineers were experienced in the layout and construction of permanent rail lines, but owners who were anxious to keep construction costs, which might reach as high as $10,000 per mile,[7] to a minimum, felt that the work of many civil engineers was more appropriate for transcontinental lines than for their roads. Logging railroads had relatively short life spans, could accept sharper curves and steeper grades, and generally did not require the same construction standards as permanent passenger and freight lines.

The operators' disenchantment with the civil engineers was also related to the managerial function of railroad location. Because the construction of the railroad was the first tangible step in opening up a tract of timber it served as the foundation upon which the entire process rested. The heart of the logging operation--the yarding of logs from where they lay in the woods to the track--was determined by how the main and spur lines wound through the terrain of a tract. A well conceived railroad would therefore be located with some consideration of the logging which was to follow. But as one operator pointed out in 1910, very few of the civil engineers "had any idea what a logging operation is."[8] Unnecessary construction expenses were thus compounded by costly errors in location because of the engineers' ignorance of the basic features of the logging industry.[9]

Logging foremen and superintendents, on the other hand, had an understanding of logging but lacked the experience to handle major railroad construction projects without making expensive mistakes.[10] Moreover, the time foremen spent locating logging spurs, landings and planning the next step in the logging operation detracted from the time which could be devoted to supervising and extracting effort from the logging crew.[11]

The third factor in the crisis of control facing coastal operators was the expansion in the scale of activities. Firms increased both the number of logging camps and the number of yarding operations or settings per camp in order to achieve the economies of scale which would justify the expense of railroad construction, operation and maintenance.[12] By 1898, for example, the Simpson Logging Company had roughly five hundred loggers working at eight camps situated along eighty miles of railroad.[13] One operator explained the ensuing loss of managerial control at the 1910 Logging Congress, remarking that in the earlier small operations the owner or manager "was able to keep in close personal touch with all the details of the work and with the men." But with the expansion in the number of logging sites over an extended area it had become impossible to maintain the "close relations" that had previously existed.[14]

By the early 1900s, then, the acquisition of huge timber tracts, inefficiencies in railroad location and construction, and an expansion in the scale of logging operations had combined to exert pressure on the traditional managerial structure. Logging operators who were forced to put a great deal of faith in their foremen because of the distances which separated the head offices of most firms from the actual logging site were searching for a way to regain control over the conception, planning and supervision of their operations. What Daniel Nelson has termed the "empire of the foreman" was under stress, as it was in other sectors of the American economy.[15]

Operators and Educators

A group of logging operators and university educators and administrators initiated a movement at the end of the first decade of the twentieth century to address the industry's managerial dilemma. This collaboration was a reflection of the closer integration of schooling and the economy which was occurring throughout American society during the early twentieth century.[16] The changing nature of the labour process and labour markets as structures of control created demands for educated labour, which was secured through an alliance of employers in major industries and educational reformers.[17] As David Noble has argued,

> In the first decade of the new century the efforts of industrial leaders to reshape the educational institutions into a valuable industrial resource of both research and manpower coincided with university efforts to extend the services they provided.[18]

The number of institutions granting degrees in engineering in the United States grew from seventeen in 1870 to 126 in 1915. Whereas less than 900 engineers had graduated from American schools prior to 1870, there were 10,400 graduates between 1891 and 1900, and 21,000 over the 1901-1910 period.[19]

In the logging industry operators and educators joined forces to bring into being engineering programs designed to combine in the logging engineer the cruiser's ability to estimate timber, the foreman's knowledge of logging, and the civil engineer's skill in railroad location and construction.[20] The graduate of the program would, in the words of Hugo Winkenwerder, the dean of the University of Washington College of Forestry,

> first of all have a thorough knowledge of the forest in all its details, secondly he must know the business end of logging in all its phases, and thirdly, enough civil and mechanical engineering so that he will understand the operation of all machinery employed in the camps and the construction and maintenance of logging roads.[21]

The most important single function of the logging engineer was to collect and present data concerning the nature of timber tracts in the form of accurate topographic maps to operators and upper-level managers which would allow them to reassert control over the conception and planning of their operations.[22] "The topographic map is the backbone of the whole scheme of logging," wrote one engineer, "upon it, if reliably constructed, one can build the entire fabric of the operating details."[23] The engineers and the maps they created would bring "scientific management"[24] to the logging industry by creating a "considerable and essential difference" as Minot Davis of the Weyhaeuser Timber Company observed in 1922, between those who conceived and planned operations, and those who performed the manual labour involved in carrying them out.[25]

Before operators could reap the benefits of topographic mapping, efficient railroad layout and construction and intense supervision of workers, they had to create an educational program which would produce individuals with the right combination of skills. The operators chose the Pacific Logging Congress to achieve this end. The development of courses of instruction at western universities was in fact one of the "underlying motives" for the creation of the Congress, and its "supreme object" would be to "direct and mold the form of instruction."[26] George Cornwall, editor of the Timberman and secretary of the Congress wrote on the occasion of the first meeting in 1909 that there was

> a growing field on the Pacific Coast for young men with a knowledge of engineering, both civil and mechanical, who will devote their time to a study of Pacific Coast logging requirements, with a view of being able to present in an intelligent and practical manner a working plan for opening up and logging a tract of timber.[27]

Frank Lamb also presented a paper at the inaugural Congress calling for the creation of "detailed topographical plots" which could provide an "accurate birds-eye view" of timber tracts and thus facilitate the formulation of rational logging plans.[28]

No mention of attempting to have programs of instruction established at the region's universities appears in the published report of the 1909 Congress, but at the same time dean Frank Miller of the University of Washington College of Forestry was concerned because the United States Forest Service had filled its personnel requirements and was no longer actively recruiting foresters.[29] Miller, undoubtedly aware of the operators' needs, was willing to chart a new course which would bring the school into line with the production requirements of the lumber industry. In about March of 1909 Miller persuaded E. T. Allen, then the district inspector for the United States Forest Service in Portland, to release W. T. Andrews from the Forest Service so that he could give lectures and conduct field work in timber cruising, mapping, log scaling and "lumbering in general."[30] Later that year Miller, Andrews, and other members of the faculty at the College of Forestry worked out a short course which was given in 1910 to about ten students.

The following year, 1911, the College of Forestry restructured its curriculum and established, in addition to its traditional program in general forestry, a four-year program of instruction in logging engineering leading to a Bachelor of Science in Forestry. An additional year of study qualified the student for a Masters degree in either area.[31] The instructor in logging engineering was E. T. Clark, a graduate of Yale who left his position as the superintendent of construction for the Standard Railway and Timber Company to join the faculty. Clark's preparations included a tour of the major logging operations in Washington and Oregon during the summer of 1911, "to investigate the different methods used and to secure advice from the leaders of the industry." The information and opinions gathered during this tour led Clark to set up a program embodying the following five "governing principles":

> First, there must be a detailed study of engineering. The logging engineer is forced to survey land lines, locate logging railroads, make estimates of costs, plan bridges, and take charge of the varied construction work about a modern logging operation. In the course of logging engineering students now receive more instruction in surveying than is ordinarily given in a college of civil engineering.
>
> Second, there must be a detailed technical training in logging. The student must study the technical details of the varied and complex logging machinery together with its operation and repair.

> Third, there must be a broad college training. Many men, some college graduates it is true, find themselves unable to take part in debate to speak in public, or to write, and the tendency to make a technical course too narrow must be guarded against, therefore a student in logging engineering is required to take work in mathematics, english, physics, chemistry, geology, and in other basic fields which will given him a broad training.
>
> Fourth, the logging engineer must receive basic training in forestry. He goes out into the forests and must understand the cruising of timber, scaling of logs, and the general laws of the growth and management of forests. In practically every logging region of the world, except in portions of the United States, logging and forestry go hand in hand. The logging engineer is the logical person to whom the company should look for advice in the handling of its forests.
>
> Fifth, practical experience must be mixed with the theoretical. Many lumbermen have criticized the college graduate, often with reason, because of his inability to adapt himself to practical work. To guard against this the logging engineer is required, during his undergraduate days, to spend his vacations as far as possible in the woods. He is assisted by the College of Forestry in securing jobs and each summer many students can be found in the forests of the Pacific Northwest working as chain-men on survey parties, in railroad construction work, on the rigging, or in various minor positions about the logging camps.[32]

Instruction consisted of lectures, field work, trips to logging operations and the facilities of equipment manufacturers. During the senior field trip students spent two months at one of the region's largest and most progressive operations cruising and scaling timber, undertaking topographic and railroad surveys and studying logging methods. The class was assigned a tract of one thousand to two thousand acres which was made the subject of topographic mapping, cruising, and for which detailed logging plans and cost estimates were prepared. Firms were quite anxious to host the field trip, as in exchange for housing and feeding the class they received the use of the topographic maps, logging plans and estimates.[33]

By 1912, then, a program of instruction in logging engineering had been established at the University of Washington. The faculty had received "many practical suggestions" from progressive operators like J. J. Donovan, and Winkenwerder had assured the industry of his intention to "have the course criticized by the practical men of the [logging industry] and revised in accordance with suggestions from these men."[34]

The logging engineering program established at the University of Washington College of Forestry represented a radical departure from traditional forestry instruction. In fact in 1912 a Representative Faculty Committee recommended that the College of Forestry be merged with the College of Engineering, a proposal which was not accepted by the university's Board of Regents.[35] When George Cornwall described the program to a group of foresters in 1912, the dean of the University of Toronto's school of forestry pronounced that the program had "little to do with forestry as I conceive it" and concluded that the theoretical foundation of forestry training was being threatened.[36] Another prominent forester articulated the same viewpoint in 1929 when he informed Winkenwerder, who was appointed dean of the College of Forestry in 1912, of his skepticism of University of Washington graduates because of "the fetish of the College of Forestry along logging engineering lines."[37] Winkenwerder was sensitive to criticism of this nature, and emphasized that all students received a "thorough basic training in forestry subjects."[38] Nevertheless, he asserted that the program represented a departure from "Old European standards of instruction" and that its object was to train "specialists in the harvesting of the forest crop."[39]

Two developments took place at the University of Washington during 1914 which confirm the role of the College of Forestry as an educational arm of the lumber industry. The school began offering a twelve-week short course in logging engineering open to any logger of at least twenty years of age who had worked a minimum of three months in a logging camp. The course was an intense session in efficient logging methods for rigging slingers, hooktenders, high riggers and others who wished to "prepare themselves for advancement."[40] Donovan informed Winkenwerder that the short course was "just the thing needed," and that he looked forward to the "much greater economy of time and money in the woods because of the men who have had the benefit of your instructions."[41] The ties between lumber capital and the College of Forestry were strengthened still further by the inclusion of a Business of Lumbering program late that year. The extent to which the university was serving the personal as well as the corporate interests of the operators is evident in Winkenwerder's admission to Donovan that this instruction had

> come almost directly as the result of the number of young men whose fathers are in the lumber business and [who] wish their sons to fit themselves for the office end of the work.[42]

The College of Forestry abandoned its fixed four-year groups of study in 1914 and offered instead one five-year course which permitted specialization along three distinct lines: state and forest service work, logging engineering, and the new forest products area of study. The first two years, taken in common, were devoted to general training in mathematics, surveying, sciences, English, and elementary forestry subjects, with the students then going on to their area of specialization.[43]

Structural links between the industry and the College of Forestry were enhanced in 1916. Upon the recommendation of Dr. Henry Suzzallo, president of the University of Washington, the Board of Regents of the university appointed an advisory committee of lumbermen, including industry leaders Donovan, George Long of the Weyerhaeuser Timber Company and James O'Hearne, to work with the faculty in the revision and development of courses.[44] That same year Suzzallo assured the West Coast Lumberman's Association of his intention to make the university the "right hand of the lumber industry of the Pacific Coast" by turning out lumbermen, not foresters.[45] Three years later the announcement of the symbolic union of the College of Forestry and the industry was made, as it became officially known as the College of Forestry and Lumbering.[46] The new emphasis on productive efficiency extended to the recruitment of students, as Winkenwerder encouraged them to "enter the work which will lead to positions with private corporations."[47]

Progress had also been made in Oregon, where it had been decided that the Oregon Agricultural College would be the most appropriate location for that state's program, and the faculty of forestry at that institution had begun putting together a course in logging engineering late in 1912.[48] The program was officially adopted and taught in 1913, after George Cornwall was named to the university's Board of Regents.[49] In 1916 John Van Orsdel, the superintendent of logging operations for the Portland Lumber Company, president and general manager of the Cathlamet Timber Company, and partner in the first firm of logging engineers in the United States was appointed instructor in logging engineering at the Oregon Agricultural College.[50] Van Orsdel retained his positions in industry while teaching, and undoubtedly spoke for the operators when he announced his intention to produce a "good citizen, executive and logging engineer all rolled into one."[51]

Movement was necessarily slower in British Columbia, where the University of British Columbia was not opened until 1915. Canada's entry into World War I and a lack of funds delayed the first training in logging engineering there until 1920.[52] But by 1916 the industry had achieved a considerable degree of success. Programs had been established and were in the hands of experienced, practical instructors at two of the region's universities, leading George Cornwall to proclaim "the recognition of the distinct place of the logging engineer in mechanical science."[53] For all intents and purposes, the educational apparatus of the state had been set in motion, not to ensure the perpetuation of the resource, but to enhance the profitability of private enterprise through its rapid and complete liquidation.

Relations between the industry and the forestry schools were, however, complex. On the one hand there was a clear unity of interests. The large lumber and logging companies required the managerial expertise which only the schools could supply, and the schools in turn needed the support of industry in the face of a reduced demand for traditional foresters. But while the forestry schools were undoubtedly the servants of corporate capital, they were not perfectly compliant or unwitting servants. The administrators and faculty of the colleges brought their own set of imperatives to the relationship which were sometimes at variance with those of lumber capital. When the goals of the industry and the schools were not in accord there was tension. While this tension did not detract from the essential dynamic--the function of the educational system in reinforcing control over the workplace--the partnership was not without a struggle for power.

The central area of discord involved the issue of practical versus theoretical training, a common feature of the relationship between industry and engineering institutions. According to David Noble,

> The gap between the engineering schools and the industries had resulted from the historical fact that the majority of engineering schools had been created as extensions not of industries, but of the established schools of science in the state and private universities. The college setting demanded that the engineering schools adopt an academically respectable approach to engineering, with an emphasis upon scientific theory rather than industrial practice. As a consequence, the schools remained relatively independent of industry and produced graduates who might be tempermentally ill-suited for disciplined industrial work and poorly trained in the application of their theories.[54]

The origins of the engineering schools were responsible for a degree of autonomy, then, in their relations with industrial capital. The fact that the western logging engineering programs were situated in forestry schools with a tradition of professional service to the state rather than industry probably exacerbated this lack of harmony.

Tension was also, perhaps primarily, a product of conflicting visions of the role the logging engineers were to play in the industry. Operators wanted the schools to turn out functionaries who possessed the proper blend of logging knowledge, mapping and engineering skills which would enable them to step immediately into the industry and perform a limited range of duties designed to allow the operators and their managers to regain administrative control over their operations. But educators and administrators like Winkenwerder had a conception of the engineers which transcended that of the operators. Winkenwerder's goal was to remedy the managerial woes of the industry by providing graduates with the theoretical background which would equip them to serve as the industry's efficiency experts. The chief engineer, according to this vision, was an autonomous professional occupying a position of rough equality with the logging superintendent, with responsibility for the conception and planning of operations. The engineer, asserted University of Washington graduate Joseph Morgan at the 1917 Logging Congress, "should be the man who goes out and picks out the settings, picks out the spar trees and then puts in the railroad."[55] But the operators preferred to retain these and other important managerial prerogatives for themselves or their logging managers and superintendents.

Individual engineers would be able to work their way into these positions, but the standing of logging engineer itself, in their view, was that of a middle manager who would provide those above him in the corporate hierarchy with essential data. More important than broad theoretical knowledge, then, was the ability to perform specific functions immediately upon entrance into the industry.

Disagreement over the content of the program at the University of Washington began at its inception. Winkenwerder was under immediate pressure from operators who, "on the plea of making the courses practical, tried their best to degrade the work to the trade school quality by cutting out theoretical work."[56] Operators urged the complete elimination of forestry courses as irrelevant to their current production requirements. Moreover, with the exception of a few "far-sighted individuals" the operators were somewhat skeptical of university graduates who lacked experience in the industry. R. D. Merrill probably expressed the view of many industry leaders who were suspicious of the university environment when he wrote Winkenwerder that a college education "sometimes unfits a young man" for work in the logging industry.[57]

Systematic industry efforts to shape the instruction in logging engineering commenced at the 1912 Logging Congress, where committees were appointed for each of the western states and British Columbia to contact the various legislatures and universities and obtain support for the establishment of full chairs in logging engineering.[58] J. J. Donovan reported at the 1913 Congress that efforts to secure funding had been unsuccessful, and recommended that the industry temporarily endow a full chair in one or more of the region's universities until state and federal funding was obtained.[59] Most operators must have shared the sentiments of George Long of the Weyerhaeuser Timber Company, however, who felt that the lumbering interests of the state of Washington already contributed enough to the support of the University of Washington through taxes.[60] Resolutions urging the industry to directly endow chairs in logging engineering were passed on an almost annual basis at the Congress, indicating the likelihood that the industry did not contribute directly to the programs, but that this was seen by some as a way of ensuring that the training would more closely fit their requirements.[61]

The committees appointed in 1912 were composed of the industry's most prominent figures, representing the largest accumulations of capital in the region. The Washington committee, for example, consisted of Donovan, George Long, and E. P. Blake, manager of the Washington Log Brokerage Company and first president of the Congress. During the first year of its existence the committee held meetings with Winkenwerder and each member gave a speech to the College of Forestry.[62] The issue of curriculum was addressed directly at the 1913 Logging Congress, where a committee consisting of the deans of the forestry schools and several operators was formed to attempt to establish a uniform curriculum in logging engineering.[63] The following year George Cornwall reported that the problem of "how to blend the intensely practical and the theoretical" had been given primary consideration. Cornwall went on to urge the operators to visit the colleges to ensure the practicality of instruction. "Here is your opportunity," he maintained, "to stamp indelibly the genius of your profession on the educational institutions of your state or province."[64]

In 1917 John Van Orsdel was appointed chairman of the committee on Logging Engineering and University Training, composed of the deans of the colleges of forestry of the states of Washington, Oregon, California, Montana and Idaho. Industry representatives were C. R. Pope of the North Western Lumber Company, J. D. Young of the Inman-Poulsen Logging Company and A. H. Powers of the Smith-Powers Logging Company. The committee was created to prepare reports for the forthcoming Logging Congress which would directly address the following questions:

> What subjects does the logging engineer use in his daily work after graduation, and how much theoretical training is necessary to make him reasonably proficient?
>
> Should a certain amount of practical work in the woods be a compulsory part of the training of the logging engineer?[65]

The questions themselves appear to have been framed by the industry, and a report delivered by Powers reflected the operators' dissatisfaction with the program of study, based largely on the graduates' lack of logging experience and a consequent inability to step immediately into the industry and perform competently. Powers suggested that the graduate logging engineer should go directly into the woods and work as a logger for a five-year period, and in this way "combine his theoretical knowledge with practical experience and make himself a valuable man for the logging industry."[66] The Congress selected another advisory committee consisting of operators R. W. Vinnedge, J. S. O'Gorman, T. P. Jones, W. R. Ballard, O. R. Johnson and J. M. Dempsey to press for more "intensely practical training" through a closer affiliation between the Congress and the schools.[67]

Efforts were initiated by Winkenwerder at the 1917 Congress to align the programs more closely with industry requirements. He drew on the examples of the plans implemented by the University of Cincinnati College of Engineering, in which students alternated experience in industry with classroom work,[68] and that of the Allis-Chalmers and General Electric companies, which offered regular training courses for graduates at nominal pay, to suggest an apprenticeship plan which would see students spend the summer months working under engineers in the region's logging camps. In this way, he explained, the students would receive valuable work experience and the operators would have the opportunity to select the best students as future employees.[69] Winkenwerder's proposal reflected sympathy with the demand for more practical experience, but no willingness to sacrifice theoretical instruction.

No further steps were taken until 1922, when a meeting between the executive committee of the Pacific Logging Congress, deans of the colleges of forestry, and a few of the most successful graduates of the program was held to discuss means of introducing a more practical emphasis to the curriculum. The essential unity of interest among the educators and operators was evident at this meeting, where the desirability of an apprenticeship plan was uniformly accepted. There was, however, disagreement over the length of the apprenticeship period and the type of work which would be involved. L. T. Murray, president of the Logging congress and owner of the West Fork Logging Company spoke for the industry when he advocated a two-year period of work as a logger before students began their training in logging engineering. Winkenwerder countered that "too long a period of manual labor would be neither necessary or helpful."[70] He repeated his proposal of 1917, that students spend their summer months working in the camps, a plan which was ultimately adopted. Several prominent firms, including Murray's West Fork Logging Company, the Bloedel-Donovan Lumber Mills, the Clear Lake Lumber Company, the McNeil and O'Hearne Logging Company and the English Lumber Company joined the apprenticeship program. The operators and educators collaborated on a Student Apprenticeship Report to be filled out on each student.[71]

Winkenwerder and George Peavey, dean of the forestry school at the Oregon Agricultural College, presented papers concerning the apprenticeship plan at the 1922 Logging Congress which reveal an enthusiastic acceptance of the concept, but a wariness of the threat which apprenticeship posed to their standards of professionalism. Peavey admitted that the field work permitted during the school year was insufficient to provide an "adequate insight into the fundamentals of the logging business," but cautioned that

> schools of engineering are not trade schools. Requiring extended apprenticeship periods savors of converting the

> engineering school into a trade school. The trade school has its proper place in the scheme of education, but it should not be grafted onto the engineering school.[72]

Winkenwerder referred to the apprenticeship plan as a "great step forward" but emphasized

> the need for keeping the proper balance between the theoretical and the practical, ie., we must not forget that nearly all progress in the great engineering problems has had its foundation in the theoretical and experimental . . . I also hope that you will realize that a university trained man should be a man with sufficient breadth of training to give him foresight, vision, and in general a broad outlook on life. His training should not be merely vocational. He should be of more value to the company hiring him . . . than being able to handle satisfactorily just merely certain kinds of routine work.[73]

The apprenticeship arrangement worked out in 1922 did not put an end to the operators' complaints about the engineers' lack of practical logging experience. They continued to voice frustration at the inability of the engineers to function in other positions, and expressed resentment at their claims to managerial status without having worked their way up through the industry in the traditional manner. "A sheepskin" asserted W. A. Erwin at the 1925 Logging Congress,

> does not necessarily mean that a graduate from college is going to make good in any line of endeavour, and hard headed businessmen nowadays particularly want a college man to show that he is willing to get in and dig and make good.[74]

Murray repeated his contention at this meeting that the students should spend up to two years learning "to become a logger," and advocated that they not work as members of engineering parties, but

> start in the woods exactly the same way everybody else starts in the woods and make good and depend entirely on themselves, with the benefit of their education and their ambition to become real loggers.[75]

Paul Freydig, a graduate engineer who had gone on to become a successful logging superintendent also advised graduates to "forget the engineering part of it and dig the knowledge out of the mud and the logs and the rigging."[76] Yet another advisory committee was appointed at the 1925 Congress to advise the schools on matters of curriculum.[77]

The mid 1920s may have represented a break of sorts between the industry and the colleges of forestry, but the election of R. W. Vinnedge as president of the Pacific Logging Congress in 1928 resulted in an attempt to renew the ties between the Congress and the schools. Vinnedge acknowledged that the industry "had not done its part by the Forest Schools and their output of young men" and expressed his desire to work together with Winkenwerder and Peavey to achieve a satisfactory affiliation of the schools and the industry, although he admitted that total satisfaction for both parties was probably impossible.[78]

What does all this reveal about the relationship between lumber capital and the forest schools? The fact that the operators were still striving to introduce a more practical emphasis to the programs of instruction after almost twenty years indicates that their ability to bring the educational system of the state to their aid, although impressive, was not absolute. Once the programs were established the operators entered into a sometimes contentious relationship with educators and administrators who did not question their role as servants of corporate capital, but who had their own ideas as to how this role could best be filled.

The conflict over practical versus theoretical training was based primarily on the engineers' aspirations for professional autonomy, set against the operators' desire for middle managers with specific engineering skills and enough logging knowledge and experience to assume other managerial positions. Winkenwerder and Peavey saw their institutions, not as a vocational school for the training of functionaries, but as the training ground for a cadre of efficiency experts possessing the appropriate blend of traditional forestry, logging and engineering knowledge to bring a new era of rational management to coastal logging. The fulfillment of this vision demanded the theoretical background which would enable the engineers to assimilate data and formulate solutions to the pressing technical problems of the industry. The operators, on the other hand, preferred that the engineers perform specific engineering functions so that they and their upper-level managers could supply their own answers. The operators were more than happy to welcome engineers into upper management who had proven their ability, and were in fact disappointed that so few seemed qualified for these positions, but were unwilling to award the engineers the autonomy they expected. The result for Winkenwerder, Peavey, and as will be shown, the engineers themselves, was frustration at the limited role the schools and graduates were able to play. Winkenwerder, for example, urged the operators in 1917 to release the engineers from the routine work they had been assigned so that they could study and solve important production problems,[79] and in 1918 he complained to Peavey that,

> The general opinion of the men engaged in the industry has not yet reached the point where they give us the credit due us in connection with their special technical problems.[80]

Neither the schools nor the graduates had therefore become the "vital force" that they were capable of becoming. This state of affairs had not changed by the end of the period under study. Peavey chastised the industry at the 1929 Logging Congress for failing to make any "systematic attempt to use the men we have graduated."[81]

Winkenwerder and Peavey, perhaps partly because of their backgrounds as foresters, laboured under the mistaken impression that the engineers would somehow operate outside the structures of control which logging operators were erecting, and of which they were an integral part. Their pleas for an expanded role in the management, ie. control, of logging operations fell on deaf ears because it had never been operators' intention that the engineers should function in any role other than as functionaries.

The Occupational World of the Logging Engineer

This section looks more closely at the engineers themselves to see what their position in relation to owners, other managers and loggers reveals about the structure of social relationships in the industry. No attempt will be made to identify the class position of engineers, who are assigned to the working class by some analysts, to the middle class by others. A brief discussion of conflicting views will, however, be presented. The purpose here is not to enter into a thorough analysis of the class structure of capitalist society, an exceedingly complex subject which falls outside the boundaries of this study, but to introduce briefly some of the themes which will emerge in our examination of the occupational world of the logging engineer.

The criteria traditionally used to determine class membership is the ownership and control of the means of production. The capitalist class (bourgeoisie) owns and controls enterprises. The working class (proletariat) must exchange its labour power at the workplace for wages in order to live. By using technology, the division of labour and management to force workers to produce greater value than they receive in wages, capital is able to exploit the working class. This surplus value is then used to intensify the labour process, further increasing the rate of exploitation.[82] A third group, the middle class (petty bourgeoisie) consists of independent farmers, small businessmen, doctors, lawyers, etc., who are primarily self-employed and who do not hire to a significant degree the labour power of others.

The expansion of educated, white-collar occupations in management, engineering and administration that has accompanied capitalist development has led some to question this orthodox approach. Bob Carter concludes that,

> by utilizing ownership and non-ownership of the means of production as the primary determinant of class membership, the orthodox Marxist approach encourages a passive, formalistic definition of class. It fails, therefore, to differentiate between

> those in the swelling ranks of the propertyless.[83]

The separation of legal ownership and control and the "differentiation of functions" within the labour process, he argues, has obscured the line between capital and labour.[84] As capitalists have withdrawn from direct supervision over the labour process they have delegated these functions to white-collar employees, creating a more complex social structure within the factory. Capital, however, retains the right to make important policy decisions and exerts overall control over the corporation, putting white-collar employees in an ambiguous position. Therefore, a significant number of individuals have occupations, "the composition of which is made up of part function of capital, part function of labour."[85] It is individuals in this category, according to Carter, that compose the new middle class. Their supervisory or control functions create an objective basis for antagonism between this group and production workers. Conversely, the fact that the new middle class is part of a collective labour process that is controlled by owners and the managerial elite provides a basis for antagonism toward the capitalist class.

A somewhat similar stance with regard to the class position of engineers is taken by Barbara and John Ehrenreich. The Ehrenreich's argue that monopoly capitalism has given rise to a distinct class which they term the Professional-Managerial Class (PMC). Distinct from capital, labour and the traditional middle class, the PMC consists of

> salaried mental workers who do not own the means of production

> and whose major function in the social division of labor may be described broadly as the reproduction of capitalist culture and capitalist class relations.[86]

Within the technical division of labour the engineers manipulate workers through the separation of the conception of work from its execution and thus reproduce the relations of production, helping the capitalist to "keep the upper hand."[87]

The Ehrenreich's attribute the rise of the engineering profession to the concentration of capital during the early twentieth century, which facilitated the transformation of science and its "practical offshoot" engineering, into tools of capital. The engineers developed new productive techniques designed to undermine workers' knowledge of and control over the production process. Therefore, although these members of the PMC sell their labour power to the capitalist, they have an "objectively antagonistic" relationship to the working class by virtue of the fact that its existence is based upon the "expropriation of skills and culture once indigenous to the working class."[88] They go on to argue that the PMC has an equally antagonistic relationship to capital, based on its desire for professional autonomy and a society run according to the "expert knowledge" it possesses.

Central to the Ehrenreich's argument is their conception of class, not purely as an economic entity, but as a "coherent social and cultural existence," comprising a common lifestyle, educational background, work habits and beliefs.[89] Based on the PMC's efforts to organize collectively through the process of professionalization, the frequency of intermarriage within the group, the high rate at which children of PMC families enter PMC occupations, and the common culture or lifestyle shared by its members, they claim that the PMC "constituted a single coherent class" by 1950.[90]

In opposition to the view of engineers as members of the middle class stands the work of Peter Meiskins, who posits that they form part of the working class. Meiskins holds that "the basic and constitutive social relationship of capitalism" is the exploitation of wage labour by capital.[91] Accordingly, the working class in contemporary capitalism is not a "homogenous entity," but consists of different kinds of wage labour who experience varying relationships with capital, and who can be in conflict with each other, but who all share the crucial experience of exploitation.[92]

As the "bridge between science and the production process," engineers were assigned the function of coordinating the labour process which had grown in scale and complexity during the late nineteenth and early twentieth centuries. Unlike those who see the engineers as part of the middle class, however, Meiskins argues that they share the same basic relationship to capital as production workers. "In terms of the relations of production," he writes,

> white-collar workers are in essentially the same position as are manual workers. As individuals, they exchange their labour power with capital and become, thereby, part of a collective labour process that is collectively exploited.[93]

Meiskins emphasizes the conflict that exists between engineers and their employers to support this position. Although engineers enjoy a favoured position in the labour process, their work is subject to routinization and rationalization, albeit to a lesser extent than production workers. Moreover, their desire for occupational autonomy "confronts the subordination and discipline required by capitalist enterprises," and relatively few succeed in rising into the executive positions to which they aspire. Forced to work according to the dictates of owners and those higher in the managerial hierarchy, unable to exert real control over the firms which employ them, and the victims of a trend toward less autonomy in their work, most engineers are therefore "in a real sense, employees."[94]

Meiskins acknowledges that most professionals and blue-collar workers do not consider themselves to be members of the same class, but attributes this to the nature of the capitalist labour process, which puts professionals in positions of power and authority relative to production workers. In addition, professionals experience less conflict with capital because of their scarcity and importance in the labour process. Finally, their work is highly paid, and more resistant to mechanization and rationalization than that of blue-collar workers. The work experience of engineers thus "lends plausibility to the illusions and ideologies of capitalism."[95] Their superior position in the labour process has an important bearing on the engineers' consciousness, causing them to identify more with corporate capital than with blue-collar workers. But Meiskins rejects the notion that this rift is a class barrier, maintaining that such a view confuses a group's function in the production process with the social relations of production.[96] According to this conception of class relations engineers are members of the working class along with loggers.

This brief discussion reveals strong disagreement as to the class membership of engineers. But more important than this theoretical dispute for the purposes of this study is the general agreement on the ambiguity of the engineers' position in the labour process. Each of the authors surveyed here have portrayed engineers as serving an intermediary function between capital and labour. Whether one agrees with Meiskins that social function is not a determinant of class membership, is in terms of the goals of this study, relatively unimportant.

Engineers share with production workers the basic fact of selling their labour power, although in a different labour market.[97] Like production workers, they are under the ultimate control of the owners of enterprises. There is, however, much that separates engineers from production workers. As recipients of the conceptual function in organizing work, they exert control over the labour process. Their university education and claims to professional status contribute to the lack of identification with workers. The gap is widened still further by their managerial aspirations, which lead to a closer identification with capital than with labour. Even those who argue that engineers are members of the working class would admit that most do not perceive themselves to be so. In terms of their role in the production process engineers occupy a position between capital and labour, sharing attributes of each class.

In order to explore the occupational world of the logging engineer directly, the career of one of the University of Washington College of Forestry's graduates will be examined. Joseph Morgan received his Bachelor of Science in Forestry in 1912 and was, in Winkenwerder's words, "one of the best men we have ever produced."[98] Morgan's career was outstanding, and therefore not necessarily representative, but it provides us with a valuable glimpse into the social relationships of the logging engineer.

After graduating, Morgan obtained a position working with S. A. Stamm, one of the first graduates of the University of Washington program, who was the engineer for the Independence Logging Company.[99] This was a kind of informal apprenticeship. As a loyal alumnus, Stamm secured work for the University of Washington graduates on his engineering crew where they could gain necessary experience. Stamm gave Morgan a "good start along the right lines" and when he was temporarily absent Morgan was put in charge of railroad layout.[100] Morgan then went on to work for the Onalaska Lumber Company where he assumed responsibility for a ten-mile mainline railroad. Morgan informed Winkenwerder that the company was "very much surprised to find an engineer who knew or at least understood anything about logging."[101] In 1915 he worked on a job in Idaho for a short time and returned to the coast looking for a position. Later that year he suffered an illness and lost an engineering job for the Port Blakely Mill Company to an "old skid road man."[102]

The following year, 1916, Morgan attempted to establish his own engineering firm with another University of Washington graduate, but the current industry slump curtailed construction work and they were unable to secure enough business to warrant continuing the venture. Later that year, however, he was able to find engineering work for the Great Northern Railroad.[103] In 1917 Morgan secured the position of superintendent of construction for the Danaher Lumber Company at Darrington, Washington. He asked Winkenwerder to send him one of the new graduates to serve as his assistant. "I will teach him all I can," he wrote, "and so repay my debts to those who taught me."[104] Winkenwerder sent Fred Madigan,[105] who went on to have his own successful career as an engineer and logging superintendent. The firm, which was equipped with two tree-rigged Lidgerwood skidders which produced approximately 250,000 feet of logs per day, and would soon have a Lidgerwood steel-spar skidder in operation, gave Morgan and Madigan the opportunity "to see logging at its greatest speed." Morgan began reaping the benefits of determined upward mobility at Darrington, where he was provided with a three-room bungalow with hot water and electric lights, quite an improvement upon the accommodations most coastal loggers were experiencing at the time.

During the summer of 1917 the Industrial Workers of the World strike shut down virtually the entire coastal industry, and the Danaher camps were no exception. That winter Morgan expressed his displeasure at "being connected with an I.W.W. camp" and was hopeful that the company would not give in to the demand for the closed shop.[106]

Early in 1918 he wrote to Winkenwerder from Darrington, "where the Wobblies are still in power and lazy as ever," that he had become the local secretary for the Loyal Legion of Loggers and Lumbermen, the United States Army sponsored organization of operators and employees designed to provide a patriotic alternative to the I.W.W. and stimulate lumber production. "You can imagine what a popular position that is," he wrote, "no real I.W.W. will join that."[107]

Later in 1918 Morgan received a promotion, raise, and "much more freedom" to carry out his work. He proudly informed Winkenwerder that,

> the I.W.W.s are going to be short lived here and I believe I can claim some of the credit in getting them out . . . as the Government gets all the information I am able to give them.[108]

Morgan's popularity with the loggers at the camp was negligible but he probably took some consolation in Winkenwerder's congratulation both on his promotion and his patriotic efforts on behalf of the Loyal Legion.[109]

By the middle of 1919 Morgan had moved on, for unknown reasons, and was working on a topographic map for a firm at Uncas, Washington. "I am on the lookout at all times," he assured Winkenwerder, "for the next step up."[110] Later that year he took just such a step, becoming the logging superintendent, "with an absolutely free hand," for the Wilson Brothers Logging Company at Independence, Washington. His own success and the demand for logging engineers in the area prompted Morgan to predict that "the day of the technical man in the logging business is just beginning to dawn."[111] By January of 1920 Morgan had moved on again, this time to become the logging superintendent for the Copalis Lumber Company, but less than two months later he had been lured back to Independence, where the new owners had offered him the position of superintendent of construction with a salary of $4,800.00, a five-room house and a percentage of the profit. The offer verified his belief that, "a good engineer should be as valuable to a logging company as its superintendent, "and raised his hopes that the time was near when, "the logging engineer and his work will be given first priority."[112]

The last word from Morgan in Winkenwerder's files comes in 1922, from Hoquiam, Washington, where he had taken a position with the North Western Lumber Company. The firm gave him the use of an automobile, and awarded him the autonomy that he apparently had not enjoyed at all of his previous stops. He informed Winkenwerder that he had

> had such a severe schooling in fighting these knot headed loggers that to see my plans working out without fighting a dozen different superintendents and managers is nothing short of a shock.[113]

Taking into consideration Morgans' exceptionally rapid ascension into positions of real authority, what does his career reveal about the logging engineers? Several important themes present themselves, the most striking of which are the value placed on, and difficulty in obtaining functional autonomy, the degree of geographic mobility, and the extent of antagonism to organized labour. Because the engineer usually entered the industry on the bottom rung of a professional ladder which was in theory intended to lead to the superintendency of either an autonomous engineering department or an entire logging operation, upward mobility was predicated on geographic mobility. Morgan, for example, worked for at least ten different firms over a ten year period, either on a contract basis or as an employee. In an essay for the University of Washington Forest Club Annual he advised students to seek out positions with the most progressive firms and search for the most challenging work. Above all, it was important not to "make the mistake of staying in one place for too long" but to learn the methods and systems of as many companies as possible.[114] After an initial period of about four years the engineer would have acquired sufficient experience to take on projects of average difficulty, and as his ability and reputation became known more significant work would follow. Of course, because many firms hired engineers on a contract basis to complete specific topographic mapping and railroad construction projects for which the engineers competed, frequent moves were an often harsh and inescapable fact of life. For the engineers, then, their lifestyle bred a severe brand of individualism and a Darwinian view of the world. "In logging engineering as in any other profession," Fred Madigan observed, "there cannot help but be those two classes that are with us in any walk of life, namely, those who make good and those who do not."[115]

This individualism was also a product of the engineers' training, which encouraged a conception of themselves as autonomous professionals. Morgan's frequent references to the degree of freedom he was experiencing with firms, and his ultimate satisfaction with the North Western Lumber Company because of the autonomy he possessed to implement his policies attests to this. But Morgan's final letter makes it clear that conflicts with other managers and operators had been frequent during his career. In order to attain real authority and control Morgan had to ascend to positions at the top of the traditional managerial bureaucracy. Although this was the intended destiny of the engineers, few were able to achieve this level during the period under study. Of the ninety-six engineers who had graduated from the University of Washington College of Forestry by 1925,[116] probably no more than ten had become superintendents of separate construction departments or entire logging operations, although the evidence permits only a general estimate.

As already shown, the position of logging engineer was not endowed with a great deal of autonomy. Morgan warned his colleagues that their greatest difficulty would be the reluctance of firms to invest the logging engineer "with enough authority to carry out his work with any degree of freedom."[117] Similarly, Lester Calder, a University of Washington graduate working for L. T. Murray's West Fork Logging Company complained in 1929 that, "we find that we must conform to the wishes of our employers whatever our own ideas might have been."[118] Another complained to Winkenwerder that it was impossible to "cooperate with a woods' foreman when I am supposedly working under the general manager," and went on to observe with disgust that the company he was with was one in which the engineer was "held responsible for a lot of things that you haven't the authority to execute."[119] When another engineer reported on ongoing conflict with other levels of management Winkenwerder expressed regret that the company was "so far behind the times" and then revealed the depth of his own disillusionment. "Personally," he replied,

> I am getting sick and tired of some would-be lumberman who does not know how things should be done, refusing to cooperate with a man who has a thorough training in his work, and I am about ready for a showdown with these fellows.[120]

In all likelihood these conflicts were also a product of the active resistance and hostility of foremen and superintendents who had earned their positions by gaining experience while working their way up an occupational hierarchy. These individuals were understandably less than enthusiastic in their reception of the university trained engineers who expected to assume positions of authority after a brief period in the industry, and were not likely to relinquish their responsibilities passively.

Another source of conflict was an engineering concept of efficiency which may have been at variance with that held by financially troubled operators and "rule of thumb" managers. Graduates complained of haphazard methods, unwillingness to make expenditures for modern machinery, and in one revealing case, "an utter lack of the knowledge of the principles of logging on the part of the management."[121]

In many cases, then, the engineers encountered a potentially hostile environment when they entered the industry. They were viewed skeptically by many operators because of their university education, lack of experience in the industry, and their concept of efficiency which may at times, have seemed impractical. Resentment from managers who had worked their way up through the ranks in the traditional manner was encountered. Some, like Morgan, Madigan, Freydig, Erwin Rengstorff and Newell Wright were able to overcome all of these obstacles and work themselves into positions of real authority, but most expressed frustration at their position in the industry, which in many camps, Winkenwerder observed bitterly in 1919 was, "not much higher, in some cases, not even as high" as a railroad section boss.[122]

Although the engineers were prepared for roles as professionals, it was also understood that they would be loyal corporate servants, a source of some tension.[123] Loyalty did not imply sustained service, but absolute devotion to the firm in its pursuit of lower operating costs. E. T. Clark emphasized that the engineer, "must constantly have the best interests of the company at heart."[124] This was a fundamental principle of the profession, and an element of creating the "right impression" which was a key to personal advancement.[125] The engineers also had to exhibit certain character traits and behaviour patterns in order to advance. "Character and moral worth" as one company executive put it, were important considerations.[126] When one graduate applied to the Long-Bell Lumber Company for a position, the firm's employment agent wrote to Winkenwerder asking for information regarding the applicant's, "character, attitude toward labor agitation, use of intoxicating beverages, and local credit rating."[127] The engineers were therefore subjected to a dimension of control which went far beyond the limitation of their role in determining company policy; to some extent they had to conform to lumber capital's conception of the ideal company man.

Each element of the engineers' makeup--their dedication to industrial efficiency, individualism, loyalty to the company in achieving maximum profits, education, and managerial aspirations--made them a group whose interests were distinct from, and antagonistic to those of the industry's workers. Although the engineers and loggers sold their labour power and worked in the same industry, they occupied separate occupational worlds. The single experience shared by engineers and loggers was a vulnerability to the vagaries of a staples economy.[128] Winkenwerder complained in 1920 that some engineers had left the industry because they were put on the same basis as "ordinary floating labor," in that they were let go during slack periods like other workers.[129] Most engineers were in fact particularly vulnerable as their work was often the first to be curtailed when conditions became uncertain.[130] "My experience has been one of ups and downs," wrote one engineer in the midst of an industry slump, "when the game has been good I've made good money, but at times like this I've spent it."[131] Shared economic insecurity did not, however, provide a basis of unity between loggers and engineers.

The engineers' attitudes toward loggers were not left to chance. Labour radicalism in the industry in the form of the Industrial Workers of the World was of great concern during the early twentieth century and operators and educators were united in the belief that the engineers should have "sound economic and labor principles drilled into their minds while students in our colleges."[132] George Peavey, the dean of the Oregon Agricultural College of Forestry suggested to Winkenwerder in the wake of the World War I unrest that because the industry "has among its workers the most inflammable element in our industrial population" it was their responsibility to "preach a new social and industrial gospel."[133] It is not known if any curriculum changes were made in the program at that school, which since its inception had featured instruction in American citizenship, executive training, and included discussion of the problems of labour organizations.[134]

The operators maintained a direct voice in the ideological component of the engineers' training through the Forest Clubs, which functioned as a meeting place for employers and students. "Carefully selected executives" made speeches to the members of the University of Washington Forest Club which often directly or indirectly concerned the engineers relationship to the industry's workers.[135] J. J. Donovan made such a speech in 1915, in which he attacked government regulation, liberal educators "who magnify the state and minimize the individual," dangerous labour leaders who spread the "destructive doctrine" of socialism, and defended protective tariffs and the open shop.[136] The speech had the desired effect on at least one listener. Winkenwerder expressed his appreciation to Donovan for "the help your address has given me in crystalizing my views on some of these subjects."[137]

Donovan presented another address to the Forest Club the following year in which he emphasized the themes of "discipline and obedience to authority," and criticized unionized workers who "give little work, draw much pay, hold back the ambitious [and] keep all on the same plane." He went on to express the fear that "the anarchist, the free-love socialist and the moral degenerate" were undermining the structure of American society.[138] "Americanism" was the theme of Clark W. Savidge's 1919 speech, in which he urged the students to take a stand on the side of democracy in the approaching confrontation with socialism.[139]

Of course, the function of the engineers was inherently antagonistic to workers, who were seen as an abstract entity to be manipulated, controlled, and eliminated whenever possible, but their opposition is even more evident when the actions taken toward workers which fall outside of their normal duties are examined. Antagonism might be expressed in an attitude, as in the case of one engineer who wished to return to university to teach for a year as it would "brush off the barbarianisms so readily picked up with close association with loggers."[140] It was also manifested in more tangible anti-I.W.W. activities, and in efforts to reform loggers. Morgan's role with the Loyal Legion has been documented. He also felt that the educational background of the engineer made him a "missionary" in the logging camps, "where the devlish agents of Bolshevism, anarchism and I.W.W.ism" were prevalent. As a product of the American educational system it was the engineer's obligation to

> step out and assert himself, to show the logger the wrong of anarchism and the right of Americanism and to let himself be known as a straight forward two-fisted fighter for good citizenship and good government.[141]

Fred Madigan drew on his experience to point out in 1919 that the engineer's political science and economics courses were excellent sources of anti-Bolshevist propaganda.[142] The previous year he had relied on his background as president of the University of Washington Forest Club to stop an incipient strike by taking over a meeting of loggers and appealing to their patriotism.[143]

The schools of forestry participated directly in the efforts to provide an alternative to the I.W.W. message and to reform loggers. Winkenwerder secured students and graduates for the Canadian Reading Camp Association to serve as directors of reading rooms and teachers of night classes which the Merrill and Ring Lumber Company and other firms operated.[144] Similarly, when the Pacific Logging Congress contemplated instituting a program of educational work in the logging camps after World War I, Winkenwerder proposed a series of lectures on the economics of the industry, "which might be worked over so that unconsciously they would be getting something along the lines of citizenship."[145]

A telling example of the engineers' relationship with loggers was the behaviour of the 1923 University of Washington field trip class while at the operation of the Simpson Logging Company. When an I.W.W. strike shut down railroad construction at the camp, J. Kenneth Pearce, who would go on to become the dean of the University of Washington

College of Forestry, volunteered the services of the class, which completed an important stretch of mainline the following day.[146] Winkenwerder's reaction to the incident is revealing:

> I am delighted to know that the boys have been able to make themselves useful in helping to get the main line so they could operate over it. I am sure that the company will appreciate that fully. I am just a little bit doubtful, however, about using the material for publicity, because it might be interpreted in some localities as being in the nature of strike breaking, which, of course, it was not, yet you know how careful we have to be in matters of that kind, when it comes to publicity. I hope the fellows enjoyed the experience they were getting out of it . . . I am sure that the impression you are making with the company will be valuable to us.[147]

He fully approved of the action because of the favourable impression which was made on the company, cynically denied that it was a case of strikebreaking, and expressed concern only about the possible negative public reaction should the incident become publicized. The attention operators and educators devoted to conditioning the subjective relations between the engineers and loggers appears to have been rewarded. The engineers accepted unquestioningly their employers' outlook toward loggers.

To summarize, the logging engineers were a new breed of managers who occupied an ambiguous place in the industrial bureaucracy. As the servants of corporate capital they exhibited relations with employers and production workers which were common to the engineering profession. Their social function was to "intensify capitalist/managerial control over the production process in order more effectively to extract labour from the workforce."[148] The flip side of this antagonistic relationship to loggers was conflict with their employers. The engineers' training, stature as autonomous professionals, and desire for an expanded role in the management of logging operators produced an internal power struggle over who would exert ultimate control. Too much should not be made of this conflict. Each party shared a devotion to the concept of industrial efficiency itself; to achieving the highest output at the lowest cost, centralizing authority over the planning of logging operations and maximizing control over the workplace.

The engineers were frustrated in their aspirations to gain a free hand in organizing the labour process by logging operators and managers who were unwilling to relinquish their traditional prerogatives. In the end, the logging engineers were kept in their place. They would serve in the role assigned to them by timber capital.

Conclusion

The impact of the engineers on the division of labour in the industry was considerable. The topographic maps they created provided operators, logging managers and superintendents with a conception of tracts which allowed detailed logging plans to be formulated in advance, far from the actual logging site. Transportation lines could be planned, the most appropriate method of yarding decided upon, landings and spar tree locations selected, and cost estimates prepared. The operator would "have his holdings in his office and cease to rely upon the sole judgement of men . . . in the field." All "inaccuracy and guesswork" would be eliminated by the substitution of "facts over judgement."[149] Here again, the ultimate goal was the creation of a factory-like setting.

Foremen were probably the most severely affected by these developments. Whereas formerly they had performed much of the planning concerning logging operations, their role was now predominantly supervisory in nature. "This redistribution of work" wrote Joseph Morgan, "makes for efficiency in all departments of the operation. The superintendent really superintends, the foreman sees that his crew produces the maximum results."[150]

The defining characteristic of the coming of rational management to the logging industry was that of a uniform exertion of control from the top down. The operator reacquired the mental picture of the tract which allowed plans to be made. If this function was delegated to the logging manager or superintendent, he possessed a means of checking their work before it was implemented.[151] The superintendent, in turn, acquired a way to monitor the performance of the foreman. In the event of low output by a crew, any explanations offered, such as steep ground or an unusually long yarding distance, could be checked against the information on the map.[152] Although all but the most skilled loggers had probably never participated significantly in the formulation of logging plans, they were now firmly excluded from the decision making process. While their work would continue to involve the exercise of considerable discretion within a limited range of functions, their role in the division of labour was now rigidly confined to the execution of the plans devised by owners and executives, while labouring under the direct supervision of lesser managers.

Footnotes

[1]Edwin T. Layton, The Revolt of the Engineers: Social Responsibility and the American Engineering Profession (Cleveland: Press of Case Western Reserve University, 1971), p. 2.

[2]See Peter F. Drucker, The Practice of Management (London: Heinemann, 1955), p. 280.

[3]Dan Clawson, Bureaucracy and the Labor Process: The Transformation of U.S. Industry, 1860-1920 (New York: Monthly Review Press, 1980), p. 253.

[4]F. H. Lamb, "Logging Engineering Requires Skill and Experience for Success," Timberman 10 (August 1909), p. 32.

[5]Cited by Cox, Mills and Markets, p. 211; see also Van Tassel, pp. 18-20.

[6]E. T. Clark, "The Logging Engineer," University of Washington Forest Club Quarterly 3 (1915), p. 56.

[7]Van Tassell, p. 19.

[8]J. P. Van Orsdel, "Topographic Survey and Its Economic Value in Logging Operations," PPLC (Portland, 1910), p. 44.

[9]"Logging Engineering and University Training," PPLC (Portland, 1919), p. 38.

[10]J. J. Donovan, "The Functions of Steam Railroads in Modern Logging," PPLC (Portland, 1910), p. 35.

[11]Clark, "The Logging Engineer," p. 56.

[12]E. T. Clark, "Pacific Coast Logging," West Coast Lumberman 38 (May 1920), p. 82.

[13]Ficken, Lumber and Politics, p. 15.

[14]W. W. Peed, "Necessity for the Logging Engineer in Modern Logging Operations," PPLC (Portland, 1910), p. 28.

[15]Daniel Nelson, Managers and Workers (Madison: University of Wisconsin Press, 1975), p. 35.

[16]Harvey Kantor, "Vocationalism in American Education: The Economic and Political Context, 1880-1930 in Work, Youth and Schooling: Historical Perspectives on Vocationalism in American Education, eds.

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[18]Noble, America by Design, p. 131.

[19]Jürgen Kocka, White Collar Workers in America, 1890-1940 (Beverly Hills: Sage Publications Ltd., 1980), p. 103.

[20]Van Orsdel, "Topographic Survey," p. 44.

[21]Hugo Winkenwerder to L. F. Place, Nov. 21, 1919, Box 14, College of Forest Resources Records, University of Washington Libraries (hereafter C.F.R.R.).

[22]A. B. Wood, "Accurate Topographical May a Good Investment in Logging Operations," PPLC (Tacoma, 1912), p. 47.

[23]S. A. Stamm to H. C. Hornby, Sept. 19, 1916, Box 2, C.F.R.R.

[24]H. P. Henry, "Economic Advantages of Topographical Surveys and Logging Plans," PPLC (Tacoma, 1912), p. 47.

[25]Minot Davis, "Just What Do We Mean By a Logging Engineer," West Coast Lumberman 42 (April 1, 1922), p. 36.

[26]"The Pacific Logging Congress," Timberman 10 (August 1909), p. 19; G. M. Cornwall, "Secretary's Report," PPLC (Bellingham, 1914), p. 2.

[27]"The Pacific Logging Congress," p. 19.

[28]Lamb, "Logging Engineering Requires Skill and Experience," p. 32.

[29]Henry Schmitz, The Long Road Travelled: An Account of Forestry at the University of Washington (Seattle: Arboretum Foundation, 1973), p. 133.

[30]W. T. Andrews, "Introduction of the Practical Teaching of Logging Engineering and Lumber Manufacture at the University of Washington," University of Washington Forest Club Annual 4 (1925), p. 34.

[31]Schmitz, p. 29.

[32]E. T. Clark, "The Development of Logging Engineering at the University of Washington," University of Washington Forest Club Annual 4 (1925), pp. 43-44.

[33]Winkenwerder to Lyle McNeil, June 10, 1913, Box 1; Mark Reed to Winkenwerder, October 27, 1923; J. K. Pearce to L. C. Rich, June 1, 1923; L. c. Rich to J. K. Pearce, June 3, 1923, Box 4, C.F.R.R.

[34]Winkenwerder to G. M. Cornwall, Oct. 17, 1912, Box 2, C.F.R.R.

[35]Schmitz, p. 30.

[36]G. M. Cornwall, "Logging as an Engineering Science," Report of the Fourteenth Convention of the Canadian Forestry Association (Victoria: Sept. 4-6, 1912), p. 47.

[37]Carl M. Stevens to Winkenwerder, March 18, 1929, Box 26, C.F.R.R.

[38]Winkenwerder to J. N. Foster, August 15, 1922, Box 4, C.F.R.R.

[39]Winkenwerder to A. N. Pack, Dec. 29, 1922, Box 4, C.F.R.R.

[40]West Coast Lumberman 29 (Nov. 15, 1914), p. 32.

[41]J. J. Donovan to Winkenwerder, Nov. 9, 1914, Box 1, C.F.R.R.

[42]Winkenwerder to J. J. Donovan, Nov. 13, 1914, Box 1, C.F.R.R.

[43]Schmitz, p. 35; West Coast Lumberman 26 (July 1, 1914), p. 27.

[44]West Coast Lumberman 30 (June 15, 1916), p. 42.

[45]West Coast Lumberman 30 (August 1, 1916), pp. 19, 30.

[46]West Coast Lumberman (April 1, 1919), p. 192.

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[49]W. A. Davies, "Western Logging Engineering Schools: Oregon Agricultural College," Logger's Handbook 11 (1951), p. 87; "Uniform

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[50]West Coast Lumberman 30 (May 15, 1916), p. 42.

[51]J. P. Van Orsdel, "How I Hope to Teach Logging Engineering at Oregon Agricultural College," PPLC (Portland-Grays Harbor, 1916), p. 34.

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[54]Noble, America by Design, p. 184.

[55]W. H. Dunn, "The Location of Logging Railroads," PPLC (Seattle, 1917), p. 14.

[56]Hugo Winkenwerder, "Progress of Education in Logging Engineering," PPLC (Vancouver, 1920), p. 33.

[57]R. D. Merrill to Winkenwerder, June 12, 1914, Box 1, C.F.R.R.

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[62]"Uniform Logging Engineering Courses," PPLC (Spokane, 1913), p. 48.

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[66]A. H. Powers, "Logging Engineering and University Training," PPLC (Seattle, 1917), p. 22.

[67]G. M. Cornwall to R. W. Vinnedge, Nov. 12, 1917; G. M. Cornwall to Winkenwerder, Nov. 13, 1917, C.F.R.R.

[68]For a discussion of this influential program see Noble, America by Design, pp. 187-89.

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[70]West Coast Lumberman 42 (April 1, 1922), p. 23.

[71]G. M. Cornwall to Winkenwerder, March 20, 1922; Winkenwerder to Cornwall, April 1, 1922; David Davis to Winkenwerder, June 2, 1922, Box 4, C.F.R.R.

[72]George Peavey, "Apprenticeship in Logging Engineering," PPLC (Tacoma, 1922), p. 36.

[73]Hugo Winkenwerder, "Students' Logging Apprenticeship," PPLC (Tacoma, 1922), p. 35.

[74]See Frank G. Miller, "Joint Report of the Pacific Coast Forest Schools," PPLC (Seattle, 1925), p. 37.

[75]Ibid.

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[77]"Resolutions Adopted by the Sixteenth Pacific Logging Congress," PPLC (Seattle, 1925), p. 43.

[78]R. W. Vinnedge to Winkenwerder, Jan. 27, 1928; G. M. Cornwall to Winkenwerder, Jan. 1, 1928, Box 6, C.F.R.R.; see also R. W. Vinnedge, "Forest Schools," Timberman 30 (Nov. 1928), p. 39.

[79]Winkenwerder, "Forest Schools and the Lumber Industry," p. 19.

[80]Winkenwerder to G. Peavey, Feb. 25, 1918, Box 2, C.F.R.R.

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[82]Pat Walker, ed., Between Labor and Capital (Boston: South End Press, 1979), p. xxiii.

[83]Bob Carter, Capitalism, Class Conflict and the New Middle Class (Boston: Routledge and Kegan Paul, 1985), p. 50.

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[85]Ibid., p. 65.

[86]Barbara and John Ehrenreich, "The Professional-Managerial Class," in Between Labor and Capital, ed. Pat Walker (Boston: South End Press, 1979), p. 12.

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[88]Barbara and John Ehrenreich, "The Professional-Managerial Class," p. 17.

[89]Ibid., p. 11.

[90]Ibid., p. 28.

[91]Peter F. Meiskins, "The Social Origins of White-Collar Work: A Study of the Evolution of Capitalist Social Structure" (Ph.D. dissertation, York University, 1980), p. 99.

[92]Ibid., pp. 321-22.

[93]Ibid.

[94]Ibid., p. 170.

[95]Ibid., p. 332.

[96]Peter F. Meiskins, "Scientific Management and Class Relations: A Dissenting View," Theory and Society 13 (1984), p. 193.

[97]See Richard C. Edwards, "The Social Relations of Production in the Firm and Labor Market Structure," in Labor Market Segmentation, eds., Richard C. Edwards, Michael Reich and Dvid M. Gordon (Toronto: D. C. Heath & Co., 1973), pp. 3-26.

[98]Winkenwerder to F. H. Madigan, August 13, 1917, Box 1, C.F.R.R.

[99]Stamm became the logging superintendent for the Merrill and Ring Lumber Company in 1929. See T. Jerome to C. L. Ring, July 15, 1929; T. Jerome to C. L. Ring, August 28, 1929, Box 73, Merrill and Ring Lumber Company Records.

[100]J. Morgan to Winkenwerder, August 3, 1913, Box 1, C.F.R.R.

[101]Morgan to Winkenwerder, Sept. 7, 1914, Box 1, C.F.R.R.

[102]Morgan to Winkenwerder, Dec. 9, 1915, Box 1, C.F.R.R.

[103]Morgan to Winkenwerder, Nov. 20, 1916, Box 1, C.F.R.R.

[104]Morgan to Winkenwerder, June 11, 1917, Box 1, C.F.R.R.

[105]See Fred H. Madigan, "Many Engineering Difficulties Overcome in Danaher Camp," West Coast Lumberman 32 (Oct. 1, 1917), p. 26; F. H. Madigan to Winkenwerder, Aug. 5, 1917, Box 1, C.F.R.R.

[106]Morgan to Winkenwerder, Nov. 21, 1917, Box 1, C.F.R.R.

[107]Morgan to Winkenwerder, Feb. 11, 1918, Box 2, C.F.R.R.

[108]Morgan to Winkenwerder, March 22, 1918, Box 2, C.F.R.R.

[109]Winkenwerder to Morgan, April 4, 1918, Box 2, C.F.R.R.

[110]Morgan to Winkenwerder, July 19, 1918, Box 3, C.F.R.R.

[111]Morgan to Winkenwerder, Sept. 9, 1919, Box 3, C.F.R.R.

[112]Morgan to Winkenwerder, Feb. 22, 1920, Box 3, C.F.R.R.

[113]Morgan to Winkenwerder, March 1, 1922, Box 4, C.F.R.R.

[114]Joseph Morgan, "The Logging Engineer's Place in Logging," University of Washington Forest Club Annual 3 (1921), p. 31.

[115]F. H. Madigan to G. M. Cornwall, Nov. 9, 1920, Box 3, C.F.R.R.

[116]Clark, "The Development of Logging Engineering," p. 45.

[117]Morgan, "The Logging Engineer's Place," p. 37.

[118]See Timberman 31 (Nov. 1929), p. 44.

[119]C. W. Kline to Winkenwerder, Nov. 6, 1923, Box 4, C.F.R.R.

[120]See Erwin Rengstorff to Winkenwerder, April 13, 1919; Winkenwerder to Rengstorff, April 23, 1919, Box 3, C.F.R.R.

[121]H. M. Lind to Winkenwerder, January 13, 1922, Box 4; see also C. W. Kline to Winkenwerder, July 3, 1922, Box 26; R. W. Pratt

to Winkenwerder, May 28, 1928, Box 26; Erwin Rengstorff to Winkenwerder, January 20, 1923, Box 4.

[122]Winkenwerder to G. Peavey, Sept. 26, 1919, Box 3, C.F.R.R.

[123]See Layton, p. 18.

[124]Clark, "The Logging Engineer," p. 62.

[125]Winkenwerder to F. H. Madigan, Nov. 23, 1917, Box 1, C.F.R.R.

[126]Multnomah Lumber and Box Co. to Winkenwerder, July 23, 1924, Box 26, C.F.R.R.

[127]R. G. Taylor to Winkenwerder, Oct. 8, 1924, Box 26, C.F.R.R.

[128]See Patricia M. Marchak, "Labour in a Staples Economy," Studies in Political Economy 2 (Autumn 1979), pp. 7-36.

[129]Winkenwerder to G. M. Cornwall, Sept. 20, 1920, Box 3, C.F.R.R.

[130]See J. W. Ottestad to Winkenwerder, Feb. 6, 1917, Box 1; E. Rengstorff to Winkenwerder, Jan. 20, 1923, Box 4, C.F.R.R.

[131]C. W. Kline to Winkenwerder, April 18, 1928, Box 5, C.F.R.R.

[132]"Logging Engineering and University Training," p. 35.

[133]G. Peavey to Winkenwerder, Nov. 20, 1918, Box 2, C.F.R.R.

[134]Van Orsdel, "How I Hope to Teach Logging Engineering," p. 34.

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[137]Winkenwerder to J. J. Donovan, Oct. 17, 1915, Box 1, C.F.R.R.

[138]West Coast Lumberman 29 (March 15, 1916), p. 78.

[139] West Coast Lumberman 37 (Dec. 15, 1919), p. 41.

[140] C. W. Kline to Winkenwerder, August 15, 1924, Box 5, C.F.R.R.

[141] Morgan, "The Logging Engineer's Place in Logging," p. 36.

[142] See "Logging Engineering and University Training," p. 35.

[143] F. H. Madigan to Winkenwerder, Feb. 5, 1918, Box 25, C.F.R.R.

[144] See Winkenwerder to J. H. Billingslea, September 22, 1915, Box 25; Winkenwerder to C. J. Nordstrom, September 22, 1915, Box 25; Winkenwerder to Merrill and Ring Lumber Co., September 27, 1915, Box 1; Alfred Fitzpatrick to E. T. Clark, March 30, 1916, Box 2, C.F.R.R.

[145] Winkenwerder to R. W. Vinnedge, Oct. 1, 1919, Box 3, C.F.R.R.

[146] J. K. Pearce to Winkenwerder, May 3, 1923, Box 4, C.F.R.R.

[147] Winkenwerder to J. K. Pearce, May 10, 1923, Box 4, C.F.R.R.

[148] David Noble, "The PMC: A Critique," in Between Labor and Capital, ed. Pat Walker (Boston: South End Press, 1979), p. 136.

[149] C. V. Wilson, "Logging Engineering," West Coast Lumberman 31 (March 15, 1917), p. 112.

[150] Morgan, "The Logging Engineer's Place in Logging," p. 35.

[151] Henry, "Economic Advantages of Topographical Surveys," p. 46.

[152] E. T. Clark, "The Making of a Topographic Map--Part III," West Coast Lumberman 35 (Jan. 1, 1919), p. 25.

CONCLUSION

During the early decades of the twentieth century, the logging industry of the Pacific Northwest underwent a crucial transformation. The closer integration of the region with expanding national and international economies provided a wide market for coastal lumber products. At the same time, the depletion of timber resources in the east and midwest prompted a rush to the forests of coastal Washington and Oregon. Timber capitalists, led by the Weyerhaeusers, the Merrills and others who followed the "cut and get out" philosophy of resource exploitation moved their operations west and took possession of vast stretches of timberland. Logging railroads opened hitherto inaccessible timber to prominent firms which employed increasingly large numbers of loggers.

The new economic order was, however, plagued by instability. The lumber economy fluctuated between boom and depression. The slackness of state and federal land laws provided easy access for new producers, creating an intensely competitive example of industrial capitalism.[1] Moreover, heavy overhead charges caused reluctance on the part of major firms to curtail operations in the face of depressed markets, resulting in chronic overproduction. "There is no question," concluded R. D. Merrill in 1916,

> that all the camps and mills now existing, operating continuously, can produce more lumber than the people of the world want to buy, or the railroads and boats can handle.[2]

Industry efforts to control competition and coordinate output more closely with demand were frustrated by the existence of many firms with conflicting interests.[3] In 1913, for example, an attempt by major independent log producers in Washington to maintain log prices when confronted by a slack market failed because of the willingness of small operators to sell logs at lower prices than those set by the association.[4] Similarly, an attempt to impose a widespread curtailment program in 1926 was greeted with little enthusiasm by Alex Polson of the Polson Logging Company. "Our firm has tried it several times," he informed Tiff Jerome, "and always got the dirty end of the stick by someone or other not living up to their end of the agreement."[5]

Pressured by an economic context of extreme market instability, intense competition and chronic overproduction, operators aggressively pursued control over production costs. Sophisticated harvesting systems were developed which increased productivity and lowered unit labour requirements. Concurrent with technological change was a growing concern with the management of operations which led to the introduction of degree programs in logging engineering at the region's universities. By 1930, then, the interlocking processes of technological and managerial innovation had combined to create a logging labour process that was taking on some of the characteristics of factory production. Aerial yarding systems subjected loggers to a higher level of technological control than known earlier, and the conception and planning of logging operations was the exclusive domain of operators and their engineers. Loggers continued to possess a good deal of autonomy at the workplace in spite of the discipline and routine which accompanied these changes. The instability of the productive environment dictated a permanent reliance on their physical and conceptual abilities to cope with changing conditions, as the IWW's success in tying up production in 1917 through a strategy of the "conscious withdrawal of efficiency" showed.[6]

One of the goals of this study is to make a contribution to labour process theory. In fact, the multiplicity of workplaces in capitalist society makes the construction of a single theory of the labour process problematical.[7] Nevertheless, the coastal logging industry exhibits features which are common to production within industrial capitalism. Capitalists, after all, share similar goals: to reduce costs and maximize profits. The achievement of these ends requires that the capitalist exert control over the labour process, in order to intensify the extraction of work from employees. As Graeme Salaman points out "the organization and design of work in capitalism represents its twin and inter-related needs: profit and control."[8]

This study took as its starting point the work of Harry Braverman, who asserted the ability of capital to deskill the workforce by separating the conception of work from its execution and introducing technologies which routinized the labour performed by production workers. Braverman's depiction of the "degradation of work" has been criticized on two major points. First, it is argued that he viewed the transformation of the labour process as the result of management strategies, and failed to take into account the broader socio-economic context of product and labour markets.[9] The second criticism concerns his conscious neglect of class struggle as a factor which structures the labour process. Braverman, writes David Stark, "portrays the capitalist class as virtually omniscient and the working class as infinitely malleable."[10] The validity of these viewpoints, each of which has been incorporated into this study, is generally accepted. This awareness of the complexity of the socio-economic forces influencing the manner in which work is organized has greatly enhanced our understanding.

Nevertheless, the conclusions reached here are generally supportive of Braverman's analysis. In terms of the first critique, it has been shown that the emergence of large but unstable markets and intense competition reinforced the operators drive to rationalize the workplace. It remains open to speculation as to whether a different economic context would have produced dissimilar behaviour by timber capital. Indeed, the changes discussed here possessed a logic that was internal to the production process. Factory-like conditions were inherently advantageous to operators regardless of the nature of the lumber economy. More to the point, these technological and managerial innovations were in fact elements of a managerial strategy. The overriding objects of the Pacific Logging Congress, which established a meeting place for operators, educators and equipment manufacturers, was to provide a medium for the exchange of ideas and to foster a "thorough and comprehensive knowledge of the most modern appliances and most scientific methods" of logging.[11]

In terms of the second criticism, fragmentary evidence suggests that loggers did not welcome the technological changes described here, and expressed their resistance by leaving those operations which were the first to introduce them. But while this resistance undoubtedly caused temporary difficulties and consternation among operators, there is no evidence to indicate that it influenced significantly the process of change. The focus on the objective content of work taken here leads to the unavoidable conclusion that operators played their hand with relative freedom. The production process was reorganized on terms favourable to timber capital, and if loggers resisted, others were obtained. All of this is not to question the important theoretical and methodological considerations which Braverman's detractors have raised, but to assert that this analysis of the coastal logging industry confirms the "long-run tendency" toward increasing capitalist control which he identified.[12]

The approach adopted in this study represents an attempt to steer between two extreme positions. The first, represented by Braverman, sees changes in the labour process as a "consolidation of untrammelled capitalist power."[13] It is vital to look beyond the enthusiastic statements contained in industry publications and management journals to uncover sources of worker autonomy, and to conceive of labour process formation as an ongoing struggle between capital and labour. It is equally important to avoid the other extreme, characterized by a "sentimentalism of the left" which overstates the success of worker resistance.[14] Reality in the coastal logging industry at the end of the period under study conforms to neither of these positions. Operators achieved a more rigid control over the labour process, but loggers had not been subordinated completely to the routine of machine production.

As a final note, it is hoped that this study leads the reader to accept less passively the prevailing concept of industrial efficiency. The term has little meaning unless one specifies what is gained and lost by different groups.[15] In the coastal logging industry what timber capital defined as efficiency meant for loggers less autonomy at the workplace and an exceptionally hazardous work environment.

Footnotes

[1]William G. Robbins, Lumberjacks and Legislators: Political Economy of the U.S. Lumber Industry, 1890-1940 (College Station: Texas A & M University Press, 1982), p. 21.

[2]R. D. Merrill to J. D. Lacey, Feb. 21, 1916, Box 6, Merrill and Ring Lumber Co. Records, Acc. 726-4.

[3]Ficken, Lumber and Politics, p. 147.

[4]T. Jerome to A. Polson, Aug. 23, 1913, Box 5, Merrill and Ring Lumber Co. Records, Acc. 726-4.

[5]A. Polson to T. Jerome, May 28, 1926, Box 6, Merrill and Ring Lumber Co. Records.

[6]See Rowan, p. 50; A. Polson to R. D. Merrill, Sept. 22, 1917, Box 7, Merrill and Ring Lumber Co. Records.

[7]Craig Heron and Robert Storey, "On the Job in Canada," in On the Job: Confronting the Labour Process in Canada, eds., Craig Heron and Robert Storey (Montreal: McGill-Queen's University Press, 1986), p. 32.

[8]Graeme Salaman, Class and the Corporation (Glasgow: Fontana Paperbacks, 1981), p. 168.

[9]Stephen Wood, ed., The Degradation of Work? (London: Hutchinson & Co., 1982), p. 17; see also Heron and Storey, p. 27.

[10]Stark, p. 92.

[11]"Address by E. P. Blake," Timberman 10 (August 1909), p. 22.

[12]See Andrew Zimbalist, ed., Case Studies on the Labour Process (New York: Monthly Review Press, 1979), p. xv.

[13]Heron and Storey, p. 28.

[14]Lawrence T. McDonnell, "'You Are Too Sentimental': Problems and Suggestions for a New Labor History," Journal of Social History 17 (Summer 1984), p. 630.

[15]Dietrich Rueschmeyer, Power and the Division of Labour (Cambridge: Polity Press, 1986), p. 171.

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Figure 1: **Aerial Interlocking Skidder**

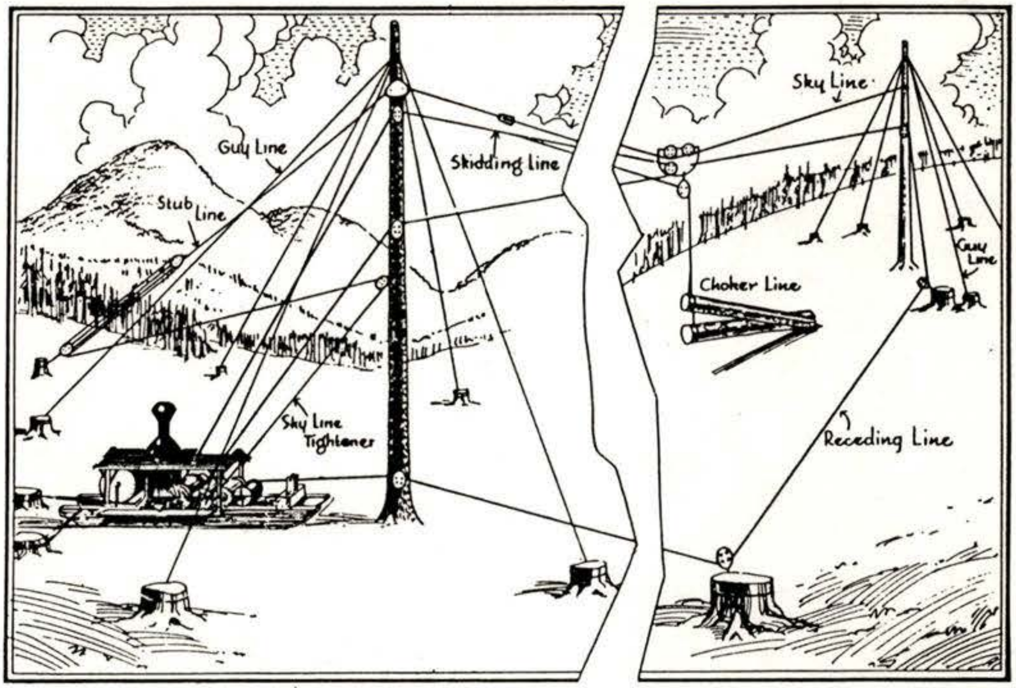
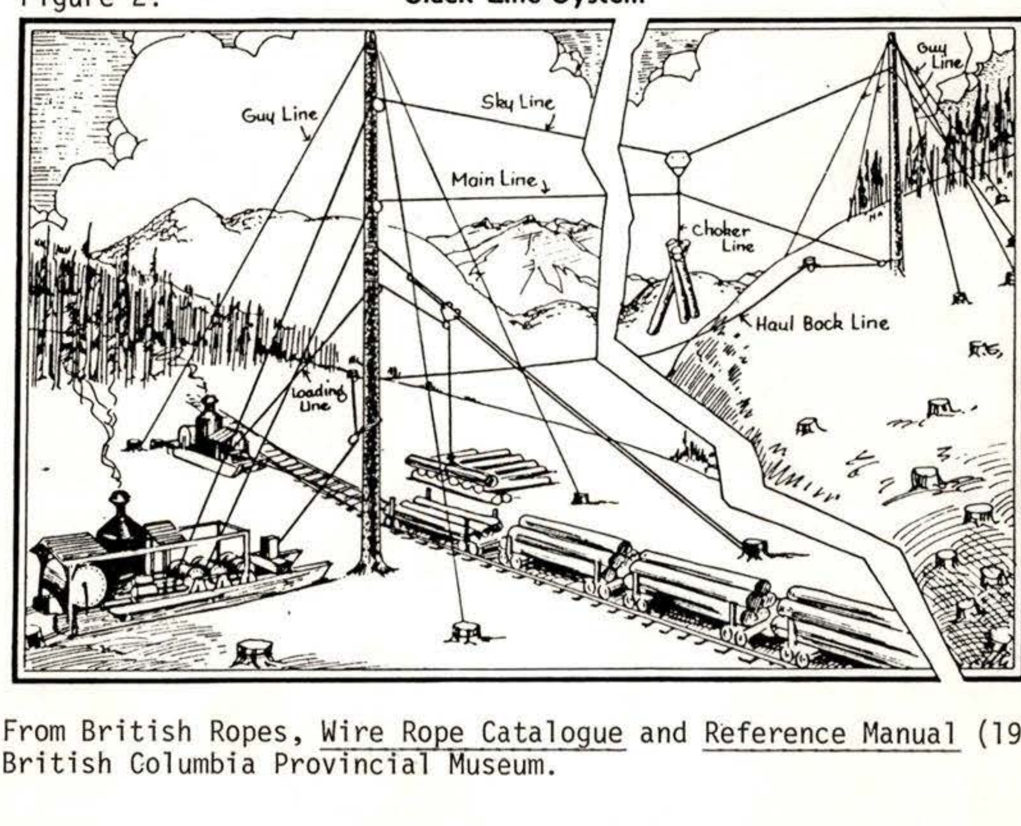
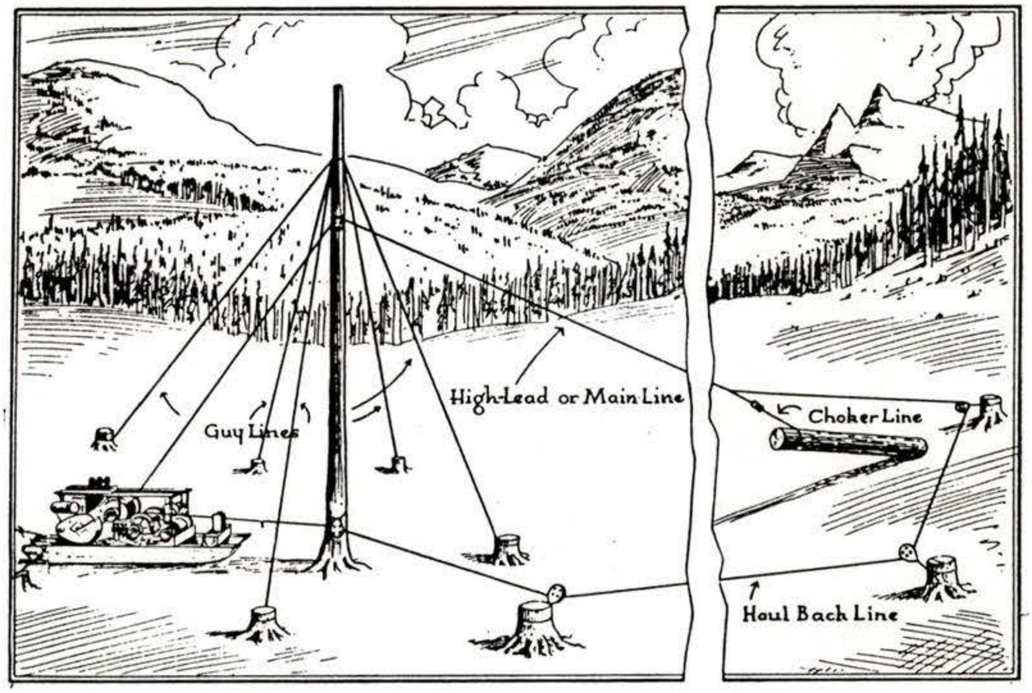


Figure 2: **Slack Line System**



From British Ropes, Wire Rope Catalogue and Reference Manual (1934). British Columbia Provincial Museum.

Figure 3: High-Lead Cold Deck



From British Ropes, Wire Rope Catalogue and Reference Manual (1934). British Columbia Provincial Museum.

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April 12 1987.
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