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Résumé de l'article

Cet article explore les changements technologiques qui ont transformé l'industrie du bois de la côte ouest à la fin du 19e siècle et au début du 20e. Les universitaires et les historiens populaires ont décrit l'avènement de l'énergie à vapeur et les systèmes verticaux de traitement du bois comme étant des réponses à des facteurs environnementaux. Cette analyse qui s'inscrit dans le contexte du débat sur les processus de travail suggère que la nature a suggéré les changements technologiques mais qu'elle ne les a pas déterminés.

Au début de la période à l'étude, l'instabilité des installations de production faisaient en sorte que les habilités conceptuelles et physiques des bûcherons contrôlaient le rythme de production. L'adoption de techniques de plus en plus sophistiquées jusqu'en 1930 avait investit les opérateurs de l'industrie du bois d'un pouvoir sans précédent dans leurs rapports avec la nature et les travailleurs. De nouveaux postes spécialisés avaient été créés mais les changements technologiques avaient pour effet, dans l'ensemble, de miner le contrôle collectif des bûcherons sur les processus de travail.

ARTICLES

The Forest as Factory: Technological Change and Worker Control in the West Coast Logging Industry, 1880-1930

Richard A. Rajala

DURING THE LATE 1800s and early 1900s, the logging labour process in coastal British Columbia, Washington, and Oregon underwent a technological revolution. In 1880 the huge timber in this region was harvested by loggers working with oxen or horse teams. By 1915, massive steam-powered engines harnessed to sophisticated overhead cable logging systems had reduced the teamsters, skidroads, and hand tools of the industry's early period to elements of a past already being portrayed in romantic, heroic terms. This paper takes a less sentimental approach to the technological changes associated with the exploitation of the forest resource in the Douglas fir region. The inquiry will be organized around two questions: what motives shaped the technologies introduced by western timber capital, and what consequences did this process hold for loggers?

Since the publication of Harry Braverman's *Labour and Monopoly Capital* in 1974, these questions have generated lively debate among labour historians, sociologists, and economists engaged in labour process study. In that the ongoing controversy has influenced many of the "organizing ideas and presuppositions" of this study, certain issues merit preliminary discussion.[1] I take the strength of

[1]Phillip Abrams, "History, Sociology, Historical Sociology," *Past and Present*, 87 (May 1980), 3-16. On the labour process debate see Craig Littler and Graeme Salaman, "Bravermania and Beyond: Recent Theories of the Labour Process," *Sociology*, 26 (May 1982), 251-69; Richard Price, "Theories of Labour Process Formation," *Journal of Social History*, 16 (1983), 91-110.

Richard A. Rajala, "The Forest as Factory: Technological Change and Worker Control in the West Coast Logging Industry, 1880-1930," *Labour/Le Travail*, 32 (Fall 1993), 73-104.

Braverman's study to be his uncompromising dissection of the capitalist mode of production. The question of power lies at the heart of this analysis: for Braverman, machines and the techniques of scientific management were introduced by capital to wrest control of the workplace from skilled craft workers. The conceptual core of his account of the "degradation of work" is the Marxian notion of labour power, which is exchanged by workers for wages. "What the worker sells and the capitalist buys," writes Braverman, "is not an agreed amount of labor but the power to labor over an agreed period of time."[2] Labour power is inert, a potential source of profit but of no value to the employer until it is transformed into work. Capitalists accordingly have engaged in a conscious effort to control production by mechanizing the workplace and separating the conception of work from its execution in order to effect this transformation on their terms, not those of the worker. Machines are thus seen to have "the function of divesting the mass of workers of their control over their own labour."[3]

Braverman's assessment of capital's overwhelming success in asserting control over production by deskilling workers has drawn the ire of the second generation of labour process analysts. Chris DeBresson, for example, argues that Braverman was a victim of his naive acceptance of managerial ideology, which represents "a manager's impossible fantasy" rather than the reality of workplace relations. Others have suggested that he not only overestimated the extent of deskilling, but also failed to recognize the creation of new, highly-skilled occupations.[4] Deskilling is only one option; capitalists can also find the existence of a highly skilled workforce to be in their best interest. These arguments are rooted in a reaction to what the second generation perceives as Braverman's worst error: his conscious disregard of class consciousness and class struggle. Individual and collective resistance, students on both sides of the Atlantic argue, plays a critical

[2]Harry Braverman, *Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York 1974), 4; see also Craig R. Littler and Graeme Salaman, *Class at Work: The Design, Allocation and Control of Jobs* (London 1984), 55.

[3]Braverman, *Labor and Monopoly Capital*, 193; for a discussion of managerial change in the industry during this period see the author's "Managerial Crisis: The Emergence and Role of the West Coast Logging Engineer, 1900-1930," in Peter Baskerville, ed., *Canadian Papers in Business History*, 1 (1989), 101-28.

[4]Chris DeBresson, *Understanding Technological Change* (Montréal 1987), 50; see also Ken C. Kusterer, *Know How on the Job: The Important Working Knowledge of "Unskilled" Workers* (Boulder 1978); Bruno Latour, "The *Prince* for Machines as well as for Machinations," in Brian Elliot, ed., *Technology and Social Process*, (Edinburgh 1988), 20-43; Paul Attewell, "The Deskilling Controversy," *Work and Occupations*, 14 (August 1987), 323-46; Bill Schwarz, "Re-Assessing Braverman: Socialization and Dispossession in the History of Technology," in Les Levidow and Bob Young, eds., *Science, Technology and the Labour Process*, vol. 2 (London 1985), 189-205; for a more fundamental critique of Braverman's reading of Marx see Paul S. Adler, "Marx, Machines, and Skill," *Technology and Culture*, 31 (October 1990), 780-812.

role in structuring the labour process. From this dialectical perspective the history of work represents not an inevitable "consolidation of untrammelled capitalist power," but a dynamic process exhibiting complexity, counter-tendencies, and possible contradictions.[5]

The critique of Braverman's determinism has produced a vastly more nuanced view of workplace change, but this has come at a price. Studies of specific industries addressing a wider range of variables, including the influence of product and labour markets in determining both the rate and nature of change, has rendered the creation of a satisfactory theory of the labour process less plausible. Instead of a unitary process of change driven in accordance with capital's all-consuming compulsion to enhance capital accumulation by achieving the formal subordination of workers, there emerges a multiplicity of labour processes, each structured historically by factors which may transcend the workplace. The most promising path out of this conceptual morass has been suggested by Sheila Cohen, who argues that critics have misunderstood Braverman's thesis. "Braverman's primary concern was not with 'control' or even deskilling," she writes, "but with the specifically capitalist logic which *constructs* these tendencies."[6] Exploitation, not control, is the "central dynamic" of capitalist production. The exertion of control by capital is thus one technique to achieve efficiency in production, which in turn is a means to intensify the rate at which workers are exploited.

Cohen's conceptualization of the labour process as the site of exploitation revives the question of efficiency, and serves as the point of departure for this study. How have logging operators and their managers defined efficiency, and in what ways has technology served the interest of timber capital in the exploitation of both workers and the resource? I hope to demonstrate that control and deskilling were indeed fundamental to the industry's concept of efficiency, and that these criteria were embedded in logging machinery and systems. The process was uneven, and increasing technological sophistication sometimes involved the emergence of highly skilled occupations, but only if these positions enhanced capital's ability to control the collective labour process.

This focus on the objective features of work in the coastal logging industry represents an unfashionable departure from the current trend in labour process study, which exhibits a great emphasis on constructing a sufficiently dialectical

[5]Craig Heron and Robert Storey, "On the Job in Canada," in Heron and Storey, eds., *On the Job: Confronting the Labour Process in Canada* (Montréal 1986), 28; see also Andrew Friedman, *Industry and Labour: Class Struggle at Work and Monopoly Capitalism* (London 1977); David Stark, "Class Struggle and the Transformation of the Labour Process," *Theory and Society*, 9 (January 1980), 89-130; Richard Edwards, *Contested Terrain: The Transformation of the Workplace in the Twentieth Century* (New York 1979); Michael Burawoy, *The Politics of Production: Factory Regimes Under Capitalism and Socialism* (London 1985).

[6]Sheila Cohen, "A Labour Process to Nowhere?," *New Left Review*, 165 (September-October 1987), 36.

theory.[7] My justification for this approach involves two positions that require some defense. First, although I accept the premise that social change cannot be understood without attention to both structure and agency, in North America on the whole, capital's right to set the technological and managerial structure of the workplace has been accepted.[8] Challenges to this power have met with little success. As I have argued elsewhere, the individual and collective resistance by west coast loggers to their conditions of employment in the early 1900s generated important changes in working and living conditions.[9] There is no evidence to suggest, however, that their opposition to dangerous and oppressive technologies had a similar outcome.

Second, although members of the Industrial Workers of the World (IWW) were critical of logging methods that displaced workers, preliminary findings indicate that the International Woodworkers of America (IWA) has not been hostile to technological innovation. A 1955 editorial in the *British Columbia Lumber Worker* asserted "industrial workers...know that it is impossible to arrest technological progress. They know that it would not be in their best interests to try." The IWA would attempt to ensure that "automation is made to provide greater abundance and leisure" but would counsel no Luddism.[10] Although the historical record reveals that loggers shared far less faith in technological progress than the above statement implies, their hostility to certain systems of exploitation has not prevented the introduction of those systems. Howell Harris' study of the American industrial relations system concludes that organized labour is "more a reactive than an initiating force in the process of social change; a weak institution in a powerfully organized capitalist society."[11] This assessment has equal, if unfortunate, relevance in the realm of technological change.

[7]Michael Reed, "The Labour Process Perspective on Management Organization: A Critique and Reformulation," in John Hassard and Denis Dym, eds., *The Theory and Philosophy of Organizations: Critical Issues and New Perspectives* (New York 1990), 63-82; John Storey, "The Means of Management Control," *Sociology*, 19 (1985), 193-211; Andrew Friedman, "The Means of Management Control and Labour Process Theory: A Critical Note on Storey," *Sociology*, 21 (1987), 287-94.

[8]Wallace Clement, *Hardrock Mining: Industrial Relations and Technological Change at Inco* (Toronto 1981), 62; Douglas M. Eichar, *Occupation and Class Consciousness in America* (New York 1989), 105.

[9]Richard A. Rajala, "Bill and the Boss: Labor Protest, Technological Change, and the Transformation of the West Coast Logging Camp, 1890-1930," *Journal of Forest History*, 33 (October 1989), 168-79.

[10]"Automation," *B.C. Lumber Worker*, Second Issue, October 1955, 4; see also "Machines and Men," *Timber Worker*, 23 September 1939, 2; "Technological Advance," *Timber Worker*, 6 April 1940, 2.

[11]Howell John Harris, *The Right to Manage: Industrial Relations Policies of American Business in the 1940s* (Madison 1982), 4.

The earliest logging on the west coast required no external power source, as trees could be cut so that they dropped directly into rivers, lakes, or inlets which provided ease of transportation. Although the hand logger plied his singular craft along the British Columbia coastline well into the twentieth century, once the timber standing in close proximity to water bodies had been cut, logging evolved into a three-stage process.[12] Trees are first felled and bucked into logs, then "yarded" to a central point, or "landing," from where they are transported to a mill for processing into lumber or pulp.

Prior to 1930, falling and bucking underwent little change. By the 1880s the crosscut saw was in use for both procedures, and hand methods prevailed until the introduction of the motorized chain saw in the 1940s. Innovations in yarding involved the replacement of oxen and horses by the steam engine or "donkey" during 1885-1900, followed by the transition from steam powered ground-lead yarding to overhead systems of logging by 1920. The final stage, transportation of logs out of the woods, was accomplished first by driving logs down rivers during the winter freshets. During the 1880s, the logging railroad appeared on Puget Sound. The technology was introduced to the British Columbia industry in the next decade. By the mid-1920s, there were 79 logging lines in the province, totalling more than 700 miles of track.[13]

These technological changes were introduced during a period of significant change in the structure of the logging industry which involved steady growth in the size of units of capital and scale of operations. Mass production in the sawmilling sector of the industry dates from the 1850s in the Pacific Northwest and the 1860s in British Columbia. But firms such as the Puget Mill Company and Port Blakely Mill Company in Washington usually purchased their logs from small, independent logging contractors who had easy access to timber along coastal waters and rivers. As late as 1882, the Port Blakely Mill Company advanced supplies, equipment and cash to some 32 operators who employed small crews working with oxen to put logs into Puget Sound.[14]

Several factors combined during the late 1800s and early 1900s to create an industry dominated, but not completely controlled, by large firms. The arrival of the Northern Pacific Railroad at Portland in 1887, the Canadian Pacific Railway at Vancouver in 1886, and the Great Northern Railway at Seattle in 1893 provided transcontinental links to an expanding North American economy while stimulating

[12]On hand logging see D.O.L. Schon, "Unique British Columbia Pioneer," *Forest History*, 14 (January 1971), 18-22.

[13]See "Logging on Puget Sound," *Washington Standard*, 5 November 1986, 1; Robert E. Swanson, "A History of Railroad Logging," *British Columbia Railway Department, Annual Report, 1954* (Victoria 1955), 7; "Logging Railway," *Lumberman and Contractor*, 2 (October 1905), 17; Robert D. Turner, *Logging by Rail: The British Columbia Story* (Victoria 1990), 48.

[14]Richard C. Berner, "The Port Blakely Mill Company, 1876-1889," *Pacific Northwest Quarterly*, 57 (October 1966), 159.

development within the region. These rail systems were completed at a time when forest depletion in the American midwest and eastern Canada prompted resource capitalists to seek new timber supplies. The westward movement of timber capital began in the 1880s and accelerated the next decade, but it was Frederick W. Weyerhaeuser's purchase of 900,000 acres of forestland concentrated in southwest Washington in 1900 that sparked a wave of speculative activity in Pacific coast timber.[15]

The Douglas fir forests of the western states attracted most of the early attention but lumbermen also turned increasingly to British Columbia, especially after American Presidents Harrison, Cleveland, and Roosevelt designated large tracts for inclusion in an emerging National Forest system. When Premier Richard McBride's Conservative government adopted a new timber allocation policy in 1905 American lumbermen and speculators eagerly took up cutting rights to British Columbia timber. In 1910 American investment in the province's industry was estimated at $65 million.[16]

Another factor encouraging concentration was the high cost of building and operating logging railroads. In order to spread these fixed costs as thinly as possible firms operated several camps, each of which was the scene of multiple yarding operations, or "sides." By 1898, for example, the Simpson Logging Company in Washington employed more than 500 loggers along 80 miles of railroad. But the new economic order was plagued by instability. Enough small operators survived to deprive the large coastal firms of monopolistic control, and competition was severe both among and within regions. Moreover, the lumber market fluctuated wildly. Organizations created to fix prices and restrict competition ultimately failed to impose control over the industry.[17]

Timber harvesting takes place in isolation from urban manufacturing centres which have drawn the lion's share of attention from labour process analysts.[18] In the field of forest history, Ian Radforth's fine study of northern Ontario logging

[15]Ralph Hidy, Frank E. Hill and Allan Nevins, *Timber and Men: The Weyerhaeuser Story* (New York 1963), 212-3; Robert E. Ficken, *The Forested Land: A History of Lumbering in Western Washington* (Seattle 1987), 94-6; Thomas Cox, *et al.*, *This Well-Wooded Land: Americans and Their Forests From Colonial Times to the Present* (Lincoln 1985), 167-8.
[16]G.W. Taylor, *Timber: History of the Forest Industry in B.C.* (Vancouver 1975), 49-74; Stephen Gray, "The Government's Timber Business: Forest Policy and Administration in British Columbia, 1912-1928," *B.C. Studies*, 81 (Spring 1989), 25-6; Jean Barman, *The West Beyond the West: A History of British Columbia* (Toronto 1991), 182-3.
[17]Robert E. Ficken, *Lumber and Politics: The Career of Mark E. Reed* (Seattle 1985), 15; W.A. Carrothers, "Forest Industries of British Columbia," A.R.M. Lower, ed., *The North American Assault on the Canadian Forest* (Toronto 1938), 308; Cloice R. Howd, *Industrial Relations in the West Coast Lumber Industry* (Washington, DC 1924), 8-28; Vernon H. Jensen, *Lumber and Labor* (New York 1945), 24-30.
[18]William H. Friedland, Amy E. Barton, Robert J. Thomas, *Manufacturing Green Gold: Capital, Labor, and Technology in the Lettuce Industry* (New York 1981), 1.

stands virtually alone as a scholarly analysis of the social process which shaped the techniques of exploitation. With the exception of Alfred Van Tassel's 1940 study of mechanization on the west coast, the industry in this region has been ignored by students of technological change. Popular historians have asserted the importance of large timber and rough terrain in moulding logging methods, but their descriptive efforts have not been matched by a corresponding passion for analytical rigour. Academics who have studied prominent lumbermen, companies, and the character of the lumber industry commonly devote a few pages to the development of logging machinery and systems, but here again generalizations about the imposing natural obstacles faced by those engaged in harvesting the resource have sufficed.[19]

In short, an overwhelming environmental determinism has dominated our thinking about technological change in west coast logging. Van Tassel, for example, interprets mechanization as a response to changes in the characteristics of the resource and its setting. "New machines and methods," he writes, "have been developed to meet changes in conditions of accessibility and size of timber."[20] Explanations based solely on the environmental imperative lack credibility on two counts. First, they carry the implicit, and extremely dubious assumption that had conditions remained constant no impetus to technological change would have existed. Second, they ignore what I will argue is the independent variable in structuring innovation: the class relationship.

Technology, radical analysts remind us, is introduced in the workplace to enhance the ability of owners and managers to control workers and increase the value produced that can be appropriated by capital.[21] Recognition of this characteristic of the labour process is vital in deciphering technology in resource extractive industries, where capital's relationship to the natural environment can so easily obscure that between owners and workers. This is not to suggest that the condition and accessibility of the staple can be ignored. Rather, it is necessary to view the forest as the arena within which the relationship between logging operators and loggers is played out. Timber capital sought domination over nature not as an end in itself, but to secure control over the activities of those they employed. One

[19]Ian Radforth, *Bushworkers and Bosses: Logging in Northern Ontario, 1900-1980* (Toronto 1987); see also Camille Georges Legendre, "Organizational Technology, Structure and Environment: The Pulp and Paper Industry of Quebec," PhD Dissertation, Michigan State University, 1977; Alfred J. Van Tassel, *Mechanization in the Lumber Industry: A Study of Technology in Relation to Resources and Employment Opportunity* (Philadelphia 1940); For a recent review of work on forest issues see Graeme Wynn, "New Views of the Great Forest," *Canadian Geographer*, 34 (1990), 175-185.
[20]Van Tassel, *Mechanization in the Lumber Industry*, 29; see also Erik Klepp, *Occupational Changes in Logging Occupations* (Olympia 1968), 1.
[21]David Dickson, "Technology and the Construction of Social Reality," in Les Levidow, ed., *Radical Science Essays* (London 1986), 20; Friedland, Barton, and Thomas, *Manufacturing Green Gold*, 4; Paul Thompson, *The Nature of Work: An Introduction to Debates on the Labour Process* (London 1983), 46.

MacMillan Bloedel manager hinted at this in 1970, stating that "changes in topography and conditions have only a minor influence on new methods...compared to economic factors." Industry's real objective in the design of logging machinery was "to reduce manpower requirements."[22]

The epitome of labour process control is the mechanized factory, and it was this model that has inspired the development of exploitation systems in the west coast logging industry. Much of the intellectual energy of innovators has been focused on the yarding procedure, the most labour intensive phase of logging, and the one in which operators have been most dependent upon the physical and conceptual skills of loggers to cope with the variable conditions of the coastal environment. Yarding, remarked J.J. Donovan, vice-president of the Bloedel-Donovan Lumber Mills, "more than any other part of the organization, makes or mars the work of a day."[23] Offering the greatest incentive for innovation, yarding would yield the most dramatic advances in technology. Although complete success in achieving the stability of the factory setting eludes operators to this day, they had made considerable progress by 1930, initially replacing animal power with the steam donkey and wire cable to "ground lead" logs to the landing. The most fundamental advance in the technique of exploitation was made during the early 1900s by harnessing steam power to overhead yarding systems.

Logging operators confronted real obstacles in their effort to emulate the factory mode of production. Unlike their counterparts who headed manufacturing enterprises, they had to organize workers and machinery within the constraints laid down by nature. Rough terrain, dense timber stands, underbrush, and the need to shift operations frequently to gain access to timber contributed to a chaotic productive context that bore little resemblance to the ordered setting of the factory. "The work of the logger is never the same," observed the Grays Harbor operator and equipment manufacturer Frank Lamb at the inaugural Pacific Logging Congress in 1909,

> 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.[24]

[22]Jim Trebett, "Logging Trends: New Equipment Necessary to Meet Government Policy of Close Utilization," *British Columbia Lumberman*, 54 (January 1970), 29. (Hereafter *BCL*).
[23]J.J. Donovan to N.L. Wright, 27 May 1913, Box 1, University of Washington College of Forest Resources Records, Acc. 70-1, University of Washington Libraries (hereafter UWCFRR); see also Clarence Ross Garvey, "Overhead Systems of Logging in the Northwest," MSc in Forestry, University of Washington, 1914, 1.
[24]Frank H. Lamb, "Logging Engineering Requires Skill and Experience for Success," *Timberman*, 10 (August 1909), 32.

Thirteen years later Minot Davis, director of logging operations for the Weyerhaeuser Timber Company, articulated an explicit contrast of manufacturing and resource extraction. "In a factory," he wrote,

> 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.[25]

In this industrial context, the strength, agility and "working knowledge" of loggers was paramount, but mechanization offered a means to subdue nature and workers by subjecting both to the machine. Operators knew full well, as William Leiss puts it, that "the intensity of the possible exploitation of human labour is directly dependent upon the attained degree of mastery over external nature." The skill embodied in human labour power was an unsatisfactory if necessary source of profit, one manager pointed out to a group of young logging engineers and foresters at the University of Washington in 1915. "While a logger can go to the manufacturer and buy a machine to do a certain amount of work," J.D. Young observed, "in purchasing labor the proposition is far different. Here there is an element of uncertainty which makes the progressive logger unhappy." Young's precise characterization of the employment relationship captures much of the dynamic behind mechanization. Operators and their managers, like A.C. Dixon of Oregon's Booth-Kelly Lumber Company would indeed find it "more satisfactory to have the smaller crew and the machine rather than the larger crew and no machine, even if there should be no variation in cost."[26]

Logging to 1890: Hand Tools and Animal Power

PRIOR TO THE 1940S, when Pacific Coast operators succeeded in mechanizing their falling and bucking operations, this first stage of logging was accomplished with simple hand tools. When Emil Engstrom worked as a head faller in 1910, he and his partner performed their task with a nine-foot crosscut saw, two long-handled falling axes, a sledge hammer, wedges, a bottle containing oil to cut through the pitch, and two springboards.[27] The head faller examined the tree to determine its "lean," observing the surrounding area so that it could be dropped without breakage. Falling a single tree could take several hours of strenuous, coordinated labour, involving considerable judgment and physical strength. Alfred Moltke's recollection provides a description of the procedure:

[25]Minot Davis, "Just What Do We Mean By A Logging Engineer," *West Coast Lumberman*, 42 (1 April 1922), 36. (hereafter *WCL*).
[26]William Leiss, "Utopia and Technology: Reflections on the Conquest of Nature," *International Social Science Journal*, 22 (1970), 583; *WCL* 29 (15 December 1915), 32; A.C. Dixon to Oregon-American Lumber Company, 2 July 1923, Box 2, Oregon-American Lumber Company Records, University of Oregon Archives (hereafter O-A Records).
[27]Emil Engstrom, *The Vanishing Logger* (New York 1956), 23.

We chopped springboard holes in the sides of the trees about five feet above the ground, cut a couple of lengths of two-by-eight rough lumber, about five feet long. On one end we shaped the board sort of round, and on one side nailed a horseshoe with the toe cleat facing up, away from the board. The new boards, called "springboards" were stuck in the holes we had chopped in the sides of the tree, then getting up on these boards we started to saw the under cut on the side we wanted the tree to fall. After we had sawed for about a half hour, we would be in the tree about a foot or fourteen inches. Removing the saw from the cut, we chopped the wood from above the cut, starting about a foot above the saw cut, and when we had finished we had made the "undercut."

Now we would swing the boards we were standing on to the back of the tree, so we could start sawing the back cut. As the average tree was six or seven feet in diameter, even that far above the ground swell of the tree, the job of cutting the back cut used up most of the day.[28]

When the tree began to drop the fallers scrambled off the springboards and ran in the opposite direction of the fall. Falling a tree over a stump or log could result in breakage, lost timber values, and consequent unemployment. "You had to save your timber," recalls Edwin Meece, "if you didn't save your timber you didn't last long." Proficient falling played a critically important part in a successful logging operation. The faller, observed R.D. Merrill of the Merrill and Ring Lumber Company in 1917, "is the most important man in the woods...as one tree broken by a good faller would mean a loss greater than two or three days wages."[29] After the tree was on the ground it was "bucked" into lengths by the bucker, working individually with a crosscut saw, axe, wedges and an eight-foot marking stick. Judgment and dexterity was required here too, as the bucker had to consider the requirements of the market and determine the location of defects which might affect the log's value.[30]

When these workers had completed their task, the yarding crew took over to begin the most problematic stage of the operation — movement of the log from where it lay in the woods to the skidroad. Construction of the skidroad was the first and most costly step in the conduct of these operations. After the route was chosen, the roadway was cleared and graded by crews using picks and shovels. In rough terrain the construction of bridges to achieve a level surface was required. Logs or "skids" were then placed across the length of the skidroad. Where curves were necessary the skids were placed closer together and elevated slightly on the inside of the curve to prevent the log from rolling off the skidroad. Skidroads were the initial technique devised by coastal operators to achieve a measure of control over the forest environment, and because of the limited power supplied by oxen and

[28] Alfred W. Moltke, *Memoirs of a Logger* (College Place 1955), 61-2.

[29] Elijah M. Meece, interview by Michael A. Runestrand, 16 June 1976, Washington State Oral/Aural History Project, 3; R.D. Merrill to C.L. Ring, 24 August 1917, Box 26, Merrill and Ring Lumber Company Records, Acc. 726, University of Washington Libraries (hereafter M & R Records).

[30] For an excellent description of bucking techniques, see Buss Griffiths, *Now You're Logging* (Madiera Park 1978).

horse teams, were engineered and constructed to exacting specifications by specialized crews or contractors. "It is in the placing of the skids," wrote one observer, "that the utmost skill is required."[31]

Skidroads offered a means of neutralizing some of the instability of coastal terrain, but in moving logs to that point operators were utterly dependent upon the abilities of loggers. Ten logs, remarked journalist Louise Wall, could be hauled down the skidroad with less effort than was required to move a single log out of the bush.[32] Expressed in terms of the relationship between employer control and worker skill, the early logging operator was wholly reliant upon the judgment and experience of his crew to overcome the variable productive setting. The yarding of each log represented an individual problem to be solved. No two logs could be dealt with in exactly the same manner; procedures varied in accordance with the size of the log, terrain, and the behavior of the team. Control rested with the loggers rather than an engineered harvesting system.

Each log was first prepared for yarding by axemen who bevelled or "sniped" the lead end of the log and removed the bark and knots from one side. Swampers cleared windfalls and other debris from a path leading from the log to the skidroad. Once these initial preparations were completed, the task of maneuvering the log to the skidroad fell to the teamster and hooktender, the dominant figures in early coastal logging operations. While the team was "prodded, sworn, and cajoled" into position by the teamster, the hooktender attached a complex arrangement of rigging involving cables and pulleys or "blocks" to the log and adjacent trees or stumps to increase pulling power and maneuverability. "A considerable amount of rude science," remarked Wall, "is required to accomplish this without accident or waste of time." An experienced hooktender could choose from several different block and tackle holds to negotiate the log to the skidroad. The "luff" recalls Lloyd C. Rogers, would help the team to generate thirty-six times its normal power. After several logs had been yarded to the skidroad they were coupled with chains into a "turn" and hauled to water by the roading team, usually consisting of six or seven yoke of oxen or an equal number of horses.[33]

Along with the hooktender, the teamster exacted control over the pace of the operation. Coordinating the efforts of up to 14 oxen to form a cohesive pulling unit

[31]"Gigantic Operation," *Washington Standard*, 18 October 1901, 1; Edwin Van Sickle, *They Tried to Cut it All* (Seattle 1980), 87; Tony Alexander, "Early Day Logging," in Mrs. Nels Olsen, ed., *The Willapa County History Report* (Raymond 1965), 29; see also John Gilbert, "Logging and Railroad Building on Puget Sound, Olympia, Washington Territory, 1878," University of Washington Libraries; C.M. Scammon, "Lumbering in Washington Territory," *Overland Monthly*, 5 (1870), 55.

[32]Louise H. Wall, "Hauling Logs in Washington," *Northwest Magazine* (April 1893), 21.

[33]Wall, "Hauling Logs," 20; Lloyd C. Rogers, interviewed by C.D. Orchard, Box 3, C.D. Orchard Collection, British Columbia Archives and Record Service (hereafter BCARS); see also Wallace Baikie, "Early Logging Days on Denman Island," *British Columbia Forest History Newsletter*, 5 (April 1983), 3.

necessitated that the bull puncher "know each bulls' characteristics" and develop a special accord with the lead oxen so the team would act in unison on his commands and gestures.[34] One logger recalls that "driving ox teams was an art," and John Reavis, who observed a bull team operation in 1899, wrote that the occupation required "great skill and nerve." "It was nothing uncommon," claimed pioneer Grays Harbor lumberman George Emerson, "for the bull puncher to be the turning point between the success and failure of a logging enterprise." Albert Drinkwater, a British Columbia horse logger, has articulated the distinctive nature of logging with animals. "There is something about a horse that isn't an engine you know," Drinkwater recalls, "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...part of the man that drove them."[35]

Special skills and a personal support with the team combined to give teamsters a high degree of control over the production process and a corresponding power in their relations with logging operators. Competition for their services appears to have been fierce. One contractor who supplied logs to the Port Blakely Mill Company complained in 1878 that a rival's offer of a higher wage "would be the means of him getting a good teamster from me." George Emerson also recalled the teamster's tendency to "quit at a moment's notice and shut down the camp." The teamster's power, reflected in his position at the peak of the wage structure and propensity to take advantage of competitive bidding by operators, would provide capital with one motivation for adapting the steam engine to coastal logging.[36]

Steam Power and the Attack on Worker Control

IN 1899, the *Pacific Lumber Trade Journal* reported that oxen were to be found in few Pacific Northwest camps, logging horses were still "much in demand," but that the trend toward steam powered donkeys for yarding was now well under way. The Victoria Lumber and Manufacturing Company was likely the first British Columbia firm to introduce a steam donkey around 1892. Until around 1910, the predominant method of yarding involved the extension of a cable from the hauling drum of the donkey to a log which was then dragged to the landing along the ground. The essential components of a donkey consisted of a vertical boiler, engine, and winch mechanism mounted on an iron or steel frame, the entire apparatus normally

[34]George P. Abdill, "Bull Team Logger," *True West*, 21 (July-August 1974), 28.

[35]Alexander, "Early Day Logging," 28; John Reavis, "Logging on Puget Sound," *Washington Magazine* (September 1899), 16; George H. Emerson, "Lumbering on Grays Harbor," *The Coast*, 14 (July 1907), 3; Albert Drinkwater, interviewed by Imbert Orchard, BCARS; see also W. Baikie, "Logging with Bulls," *British Columbia Forest History Newsletter*, 8 (April 1984), 3.

[36]D. Varney to Port Blakely Mill Company, 1 January 1878, Box 71, Port Blakely Mill Company Records, University of Washington Libraries; Emerson, "Lumbering on Grays Harbor," 3.

resting on a wooden sled to facilitate moving. The earliest machines were adaptations of hoisting engines used as pile drivers or for loading cargo on ships. In 1882, California lumberman John Dolbeer was granted a patent for his side-spool "Steam Logging Machine," the first engine designed specifically for Pacific Coast logging. The following year Dolbeer received a patent on an "Improved Logging Engine" which featured a vertical spool, or capstan. In all likelihood this was the first donkey used by operators in the Pacific Northwest and British Columbia.[37]

The traditional explanation for the adoption of steam-powered yarding is that operators were responding to timber depletion. According to Van Tassel, as "the timber line receded before the logger's axe" they took to the logging donkey because of the longer distances involved. More recently, Robert Ficken has argued that the donkey "made it possible to move logs over longer distances, at a more rapid pace." It is true that yarding with oxen was limited to a distance of about one mile. Sol Simpson informed the Port Blakely Mill Company in August of 1888 that his team was "too slow on a long road in hot weather" to haul beyond this distance.[38] Horses were faster on the longer hauls, but the real answer to increased hauling distances was the railroad. A contractor advised the same company in 1885 against construction of a skidroad near Skookum, Washington 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." A more fundamental weakness of the timber-depletion interpretation is its failure to recognize that steam donkeys were first put to use yarding logs to the skidroad; from this point horse teams took over. Longer hauling distances, then, cannot account fully for the introduction of the steam donkey.[39]

Mechanized logging offered logging operators a range of advantages: increased control over terrain; faster yarding at lower costs; and a fractional reduction in their reliance on the skills of loggers. Oxen and horses tired quickly in the hot

[37] "Pacific Coast Logging Methods," *Pacific Lumber Trade Journal*, 5 (August 1899), 10 (hereafter *PLTJ*); Donald McKay, *Empire of Wood: The MacMillan Bloedel Story* (Vancouver 1982), 16; W.H. Corbett, "Development of the Logging Engine," *Columbia River and Oregon Timberman*, 3 (January 1903), 66; Peter J. Rutledge, "Genesis of the Steam Logging Donkey," *Timberman*, 35 (March 1933), 10; Peter J. Rutledge and Richard H. Tooker, "Steam Power for Loggers: Two Views of the Dolbeer Donkey," *Journal of Forest History*, 14 (1970), 27; "Dolbeer's Logging Engine," *WCL*, 3 (May 1892), 6 Emerson, "Lumbering on Grays Harbor," 3.

[38] Van Tassel, *Mechanization*, 31; Ficken, *The Forested Land*, 70; see also Michael Williams, *Americans and Their Forests: A Historical Geography* (New York 1989), 301; Sol G. Simpson to Port Blakely Mill Company, 18 August 1888, Box 68, Port Blakely Mill Company Records.

[39] Edward Miller to Port Blakely Mill Company, 20 February 1885, Box 48, Port Blakely Mill Company Records; Robert Brian Griffin, "The Shawnigan Lake Lumber Company, 1899-1943," MA Thesis, University of Victoria, 1979, 37; Ray Raphael, *Tree Talk: The People and Politics of Timber* (Covelo 1981), 13; E.T. Clark, "Pacific Coast Logging," *WCL*, 38 (1 May 1920), 81-2.

summer months, and rain and snow frequently forced a curtailment of animal-powered operations. Freezing conditions offered little relief as the hard ground necessitated constant shoeing of animals — a laborious, time consuming procedure. But while steam power would be less subject to coastal weather, rain and muddy conditions continued to hinder steam-powered ground-lead logging.[40]

There were, in addition, costs associated with animals which the mechanized operator did not have to meet. Unlike machines, oxen and horses required training, aged quickly, and had to be fed even when not working. The animals themselves were expensive. Sol Simpson paid $1,400.00 for seven yoke of oxen in 1889 and the Percheron and Clyde horses which replaced oxen in his camp for a time cost as much as $500.00 each. Steam donkeys offered the possibility of higher yarding speeds, required no training, and did not have to be fed when idle. All of these factors could figure into a company's decision to purchase a donkey. A Brunette Sawmill Company manager informed a shareholder in 1896 that he had sold the firm's aging logging cattle because they had been "eating their heads off" and went on to prescribe the purchase of steam donkeys "as the cattle is too slow to log to any advantage." Moreover, he pointed out "the fuel is on the ground...and when we shut down for the rainy season all the expense could be shut off."[41]

Although it is difficult to attach relative weights to the factors involved, at least one operator associated mechanization with a diminution of the control exerted over production by the teamster. In recalling the high wages paid to teamsters and their propensity to quit on short notice and shut down logging, George Emerson remarked 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 hails the displacement of the teamster rather than the elimination of the animals. The occupation of donkey engineer demanded judgement but the new skills were more easily acquired than those of the teamster, and the latter's personal rapport with the team was no longer part of the equation.

In operation, the chokerman, working under the direction of the hooktender and his assistant the rigging slinger, put the chokers around the logs and hooked them to the haul-in line. After the chokermen were in the clear, the hooktender or rigging slinger signalled to the donkey engineer who engaged the yarding drum, starting the log to the landing. In addition to the engineer, donkeys required wood buckers and firemen to fuel the machines, and a spool tender, who took the turns

[40]D. Varney to Port Blakely Mill Company, 17 February 1878, Box 71; Blackman Brothers to Port Blakely Mill Company, 10 January 1878, Box 36; Edward P. Miller to Port Blakely Mill Company, 20 February 1885, Box 36, all in Port Blakely Mill Company records; Alex Polson to R.D. Merrill, 28 September 1905, M & R Records, Acc. 726-4.

[41]S.G. Simpson to Port Blakely Mill Company, 8 May 1889, Box 68, Port Blakely Mill Company Records; Stewart Holbrook, *Green Commonwealth* (Simpson Logging Company, 1945), 34-5; H.W. McDonald to Alexander Barnet, 4 December 1896, Reel 8, Barnet Family Papers, Public Archives of Ontario.

[42]Emerson, "Lumbering on Grays Harbor," 3.

of manila rope off the capstan as the log was pulled in. After the log had reached the landing the rope was fastened to the line horse by a worker who guided the animal to the next log to be yarded. Operators soon replaced manila rope with flexible steel cable. The new "wire rope" was an improvement over the manila rope, which had stretched and slipped when wet.

Shortly after the Dolbeer came into use in the coastal woods, engines made by eastern manufacturers of hoisting equipment such as the Lidgerwood and Mundy began to appear, although they were not well suited to the huge coastal timber.[43] During the 1890s coastal machinery companies, including the Washington Iron Works in Seattle, Portland's Willamette Iron and Steel Works and the Albion Iron Works and British Columbia Iron Works, both in Vancouver, recognized the market potential of the expanding logging industry and began producing machines designed to meet regional demands. The first donkeys produced by these manufacturers were capable of higher speeds than the Dolbeer, due in part to the introduction of the horizontal yarding drum, which displaced the spool tender. Mechanization of yarding advanced further with the development of the two-drum donkey, which eliminated the line horse. Instead of the line horse plodding back to the next log with the mainline, 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 around the setting to the donkey. This innovation accelerated the yarding procedure; now when the log reached the landing and was unhooked from the mainline the donkey engineer simply reeled in the haulback line, returning the mainline and rigging to the crew in the woods.[44]

The introduction of steam power and the development of more powerful and sophisticated logging donkeys had a significant impact on the nature of loggers' work but did not revolutionize the harvesting process. The pace of production still hinged 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. Timber capital continued to be dependent upon the abilities of loggers to cope with a productive setting which was anything but factory-like. Log preparation, involving sniping and barking, was a necessity and swampers continued to clear a path to the skidroad. Negotiating the passage of a log over rough, stump covered terrain remained a tortuous affair. The limited power sup-

[43] L.T. Murray, interviewed by Elwood R. Maunder, 1957, Forest History Foundation, 23, University of Washington Libraries.

[44] "Logging Methods in British Columbia," *Canada Lumberman*, 22 (November 1902), 8; "The Development of the Logging Engine," *West Coast and Puget Sound Lumberman*, 13 (January 1906), 167; G.A. Walkem, "Evolution of the British Columbia Logging Industry," *BCL*, 10 (August 1926), 97; H.R. Christie, "Logging Methods on Vancouver Island," *Canada Lumberman and Woodworker*, 36 (1 September 1916), 78-80; "Recent Progress in Power Logging Equipment," *Western Lumberman*, 8 (August 1921), 76 (hereafter *WL*).

plied by early donkeys necessitated frequent use of auxiliary rigging.[45] Decisions concerning the use of block and tackle to increase pulling power and the placement of blocks to manoeuvre the log 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."[46]

No matter how powerful the donkey, when the log approached a block, through which the mainline ran, yarding was halted while the chaser unhooked the choker, took it out of the block and reattached it 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. Although this increased output somewhat, hang-ups were frequent as the log was yarded in, requiring changes in choker holds to roll the log away from stumps and other obstructions.[47] R.V. Stuart described ground-lead logging as "the most frustrating and irritating business that you could imagine." Stuart went on to recall the "turmoil" of ground-lead logging:

> 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, they had to change the choker and go another fifty feet. There was a lot of jumping back and forward.[48]

In short, the initial application of steam power to logging failed to achieve the stability of the factory setting, in which the technological structure of the workplace sets the pace of production. The yarding of each log continued to represent an individual problem requiring coordinated effort by the yarding crew.

The limitations inherent in ground-lead logging should not, however, obscure the fundamental transformation which occurred during this period. Once the superiority of steam donkeys and wire rope over oxen and horses had been established, and the expansion of the coastal lumber industry created a permanent market for the products of equipment manufacturers, a relationship was forged between the engineering staffs of these concerns and timber capital. Henceforth, the process of technological innovation would become "self-reinforcing and cumulative," with the profits of both timber companies and the manufacturers of

[45]Rutledge and Tooker, "Steam Power for Loggers," 27; William H. Gibbons, *Logging in the Douglas Fir Region* (Washington, DC 1918), 72.
[46]Richard H. Kennedy, "Logging Our Great Forests," *Pacific Monthly*, 13 (January 1905), 28.
[47]Curt Beckham, *Gyppo Logging Days* (Myrtle Point 1987), 7; John Van Orsdel, "Machine Yarding and Loading," *Proceedings of the Pacific Logging Congress* (Bellingham, 1914), 44 (hereafter *PPLC*); D.H. Grigg, *From One to Seventy* (Vancouver 1953), 53; J. Kenneth Pearce, "Fifty Years of Colorful Logging — A Look Back," *Western Conservation Journal* (September-October 1959), 31.
[48]R.V. Stuart, interviewed by C.D. Orchard, p. 10, C.D. Orchard Collection, BCARS.

logging machinery dependent upon the introduction of cost saving technologies.[49] What Francis Frink of the Washington Iron Works termed a "sharing of ideas" among operators, their master mechanics and superintendents, and the equipment producers emerged, the latter serving as the medium through which recent developments in science and technology met the demands of timber capital. Industry slumps would prove especially conducive to innovation, as operators confronted with lower market prices sought ways to reduce operating costs, and engineering staffs had time to devote to research and development.[50]

Timber capital and machinery manufacturers shared a desire to increase productivity at lower costs per unit of production. Power rather than speed was the key to ground-lead logging, and the introduction of more powerful compound-geared donkeys was the chief means of reducing the need for loggers to apply rigging to manipulate the log around minor obstructions. Increases in engine cylinder size from seven to nine inches brought additional power, and the Willamette Iron and Steel Works "Mogul" yarder, introduced in 1906, featured cylinders eleven inches in diameter. Machinery manufacturers attempted to satisfy demands for faster yarding by increasing the diameters of mainline 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." Increasing the size of the haulback drums accelerated the return of rigging to the woods, a measure designed to "keep the yarding crew constantly on the jump."[51]

The power and line speeds of more sophisticated steam donkeys and cable yarding systems gave loggers their initial experience of machine pacing; the productive apparatus itself began to dictate the rate at which they performed their tasks. A related consequence of timber capital's new ability to exert control over the environment involved a subtle diminution of loggers' skills, as the power of the large donkeys made obsolete some of the rigging skills formerly needed to increase power and avoid obstructions.[52] The shift in control over logging operations was also reflected by changes in the wage structure. The teamster had previously earned the highest wage in the logging crew but his replacement the donkey engineer now earned less than the hooktender, who drew the highest wage.[53] The donkey engineer was far from an unskilled worker, but the power for logging operations was now

[49]See Paul A. Baran and Paul M. Sweezy, *Monopoly Capital: An Essay on the American Economic and Social Order* (New York 1966), 70-2.

[50]Francis Frink, interviewed by Elwood Maunder, 1958, Forest History Foundation, 8-10.

[51]L.T. Murray, "Changes in Type of Donkey Engine," *WL*, 11 (November 1922), 56; W.H. Corbett, "The Larger Yarding Engine," *Timberman*, 7 (April 1906), 33; W.H. Corbett, "The Era of the Big Drum Yarder," *Timberman*, 6 (April 1905), 320.

[52]James O'Hearne, "How Shall We Teach Logging Engineering," *PPLC* (Spokane 1913), 21.

[53]D. Varney to Port Blakely Mill Company, 6 March 1878, Box 71, Port Blakely Mill Company Records; *Labour Gazette*, 8 (September 1908), 308; "Coast Logging Conditions," *PLTJ*, 10 (August 1904), 11.

supplied 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 embodied the potential to increase managerial control by implementing a more rigid division of labour. Firms such as the Portland Lumber Company in Oregon and the International Timber Company on Vancouver Island purchased extra donkeys and rigging, and hired special rig-up crews to establish the productive system in advance of logging. When one setting was completed or breakdowns interrupted logging, the yarding crew moved to a new area with a minimum disruption of production. The new division of labour possessed an additional benefit; workers employed on the rig-up crew were "not such high-priced labour."[54]

Finally, machine yarding sharply increased the dangers associated with logging. The tremendous strains under which wire rope, shackles, and blocks were under caused breakage, creating a more hazardous workplace. Evidence of how loggers responded to the introduction of steam power is fragmentary, but it appears that the new technology was not welcomed. Francis Frink admitted that mechanization was "resented in some camps." One Humbolt county operator recalled in 1921 that local loggers refused to accept the two Washington Iron Works donkeys he purchased in 1906, forcing him to import crews from another region. Loggers at a Vancouver Island camp took a similar stand when steam power was introduced. Here, too, other crews were brought in.[55]

As the industry moved overwhelmingly to steam power at the turn of the century, loggers would have little choice but to accept the new technology or leave the industry; a choice fraught with uncertainty in a regional economy which offered a limited number of alternative employment opportunities for those with industry-specific skills. Loggers' resistance to mechanization did not present an unsuperable obstacle to timber capital's efficiency drive, but the impact of steam powered ground-lead logging should not be exaggerated. Even the most powerful donkeys did not free operators from dependence upon the conceptual and physical skills of the hooktender and crew to negotiate each log to the landing in an unstable and uncertain environment.

Overhead Logging: The Flying Machine and the Factory Regime

THE OVERHEAD YARDING METHODS which came into use in the coastal woods after 1900 fall, at the risk of over-simplification, into two main categories: skidder systems, involving the suspension of cables and rigging from two spar trees; and

[54]Van Orsdel "Machine Yarding and Loading," 45; Charles S.L. Koelsche, "Yarding and Loading Logs," *PPLC* (Bellingham, 1914), 42.

[55]Andrew Mason Prouty, *More Deadly Than War: Pacific Coast Logging, 1827-1981* (New York 1985), 62; Frink, interview by Maunder, 3; E.S. Grammer, "Evolution of the Logging Donkey," *PPLC* (San Francisco 1921), 32; *BCL*, 26 (December 1942), 44.

high lead logging, which featured a single spar tree. Although the numerous systems varied widely in operation, each was an advance over the laborious ground yarding method by allowing logs to be pulled to the landing while partially suspended in the air. With this innovation, the capacity of logging operators to exploit both nature and workers received a significant boost.

Overhead yarding was first employed in Michigan about 1886, and by the mid-1890s the Lidgerwood skidder system was in widespread use throughout the midwest and cypress swamps of the southern states. On the Pacific Coast, aerial transportation was first achieved by Oregon's Bridal Veil Lumber Company, which in 1901 "swung" logs to a railway after they had been ground yarded to the landing. The initial direct overhead yarding out of the woods was accomplished the following year by the Lamb Lumber Company at Hoquiam. The Kerry Mill Company at Kerriston, Washington introduced the Lidgerwood skidder to the coastal region that same year. In 1903 the Lidgerwood Company established an office in Seattle, and shortly thereafter acquired the patents to Lamb's cableway system.[56]

The initial Lidgerwoods used on the coast had been developed for harvesting smaller timber elsewhere on the continent. Breakdowns were frequent, but in 1912 the firm began advertising a tree-rigged skidder designed specifically for coastal conditions. By this time many of the largest firms in the region had adopted the Lidgerwood system, and within a few years other northwest producers such as the Willamette Iron and Steel Works, Washington Iron Works, and Empire Manufacturing Company in Vancouver had developed their own skidders.[57]

The Lidgerwood system featured a cable suspended between two spar trees. Through a complex arrangement of lines and blocks, a carriage was drawn back and forth between the skidder at the landing and the rigging crew. When it reached the chokermen, they hooked the chokers to the "in-haul" line. The engineer then applied power, raising the logs off the ground, and yarded the load to the landing. A complete set of components could be obtained for about $30 thousand in 1914, and there were less expensive alternatives, such as the MacFarlane and North Bend systems, developed and patented by innovative operators.[58]

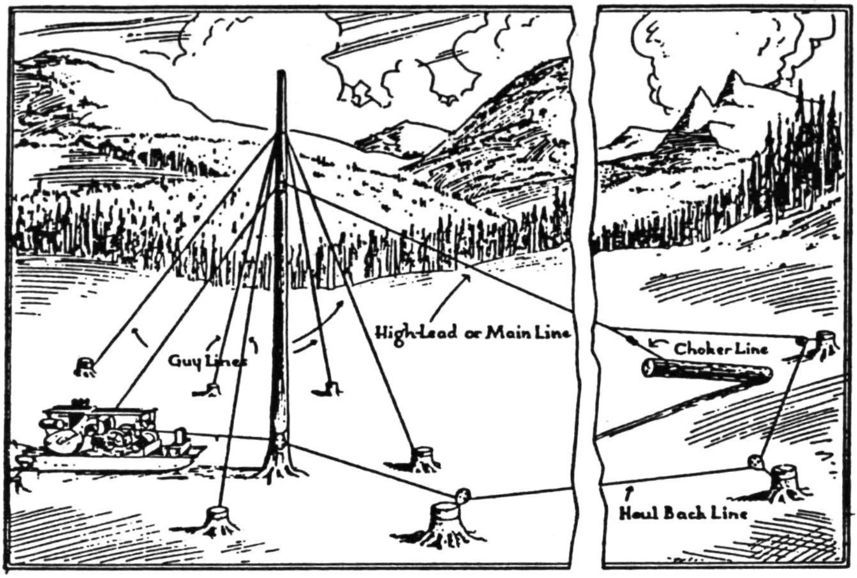
A still less costly way to achieve a similar effect was the high-lead, in which a mainline was passed through a block atop a single spar tree, then through a series

[56]W.S. Taylor, "Different stages in the Evolution of Overhead Systems of Logging," *Timberman*, 15 (January 1914), 30; "Hauling Logs Through Mid-Air," *PLTJ*, 7 (May 1901), 11; "The Lamb Cableway System," *Columbia River and Oregon Timberman*, 4 (August 1904), 21-3; "The Evolution of Coast Logging," 21.

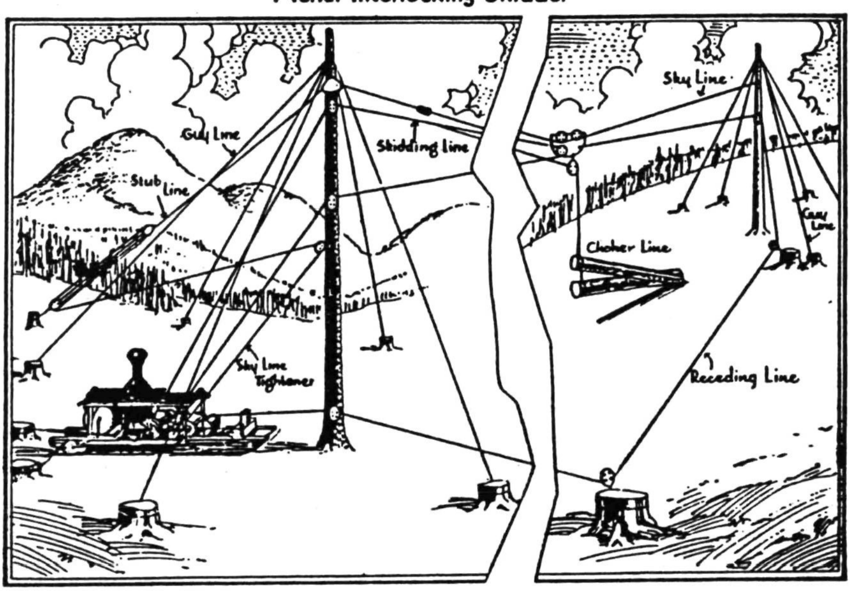
[57]"Aerial Skidding Not an Experiment, Lidgerwood Invention Twenty-Seven Years Old," *WCL*, 25 (1 November 1913), 27; R.W. Vinnedge, "Overhead Logging Systems," *PPLC* (Tacoma, 1922), 14; "Yarding Logs With Empire Cableway Skidder," *WL*, 13 (September 1916), 31.

[58]*WCL*, 29 (1 January 1916), 34; for description of the many different overhead systems see K. Berger, "Skyline Methods Used for Logging," *BCL*, 10 (September 1926), 82-3.

High-Lead Cold Deck



Aerial Interlocking Skidder



of blocks around the perimeter of the setting and attached to the haulback line. The high-lead provided less elevation and an effective yarding distance of about 600 feet, allowing a "turn" of logs to pass over obstructions as they were pulled to the landing. The origin of the high lead is unclear. One manager suggested in 1916 that the technique had been first used at two coastal camps about a decade earlier, but had come into widespread use only in the previous two years. By 1915 the method was acknowledged to be in "very general use" on the coast, and skidder systems were increasingly prevalent.[59]

The accepted wisdom concerning the transition to overhead methods is that operators were responding to the problem of handling large timber on increasingly difficult terrain as logging progressed inland from the coast line and river valleys. Popular historians and scholars alike have advanced the environmental imperative to explain the new logging system.[60] Certainly there is evidence to support this conclusion, for operators voiced continuous complaints about the higher logging costs which accompanied harvesting on rough ground. But a close reading of the data casts doubt on this explanation. The Merrill and Ring Lumber Company was probably the second Washington firm to purchase a Lidgerwood skidder. After a favourable report by the company's logging superintendent on the operation of the Kerry Mill Company's skidder in October 1908, Merrill and Ring purchased its first Lidgerwood the following month. The first six months of operation proved a "huge success," and by 1911 the company had three such units.[61] We should expect to find Merrill and Ring executives stressing environmental factors in their discussions of the new technology. But when R.D. Merrill presented a paper to the Pacific Logging Congress in 1911, he reported that the skidders were being used on "level ground" and that "only experience would show how well it would do on rougher conditions." It could be argued that Merrill was referring to an initial trial period, but as late as 1916 the company's secretary-manager Tiff Jerome replied to the inquiry of another firm that the three skidders were in use on "comparatively level ground."[62]

[59]James O'Hearne, "Description and Value of High Leads," *PPLC* (Portland-Grays Harbor, 1916), 16; Josiah T. Shull, "Overhead Logging on the Pacific Coast," MSc in Forestry Thesis, University of Washington, 1926, 19; George Cornwall, "Secretary's Report," *PPLC* (San Francisco 1915), 5.

[60]Shull, "Overhead logging on the Pacific Coast," 11-2; Griffin, "The Shawnigan Lake Lumber Company," 45; Williams, *Americans and Their Forests*, 316-7; Dorothy O. Johansen, *Empire of the Columbia: A History of the Pacific Northwest* (New York 1967), 403.

[61]T. Jerome to R.D. Merrill, 9 October 1908; Jerome to T.D. Merrill, 16 November 1908, Box 2; Jerome to Salsich Lumber Company, 1 February 1910, Box 3, M & R Records, Acc. 726-4.

[62]R.D. Merrill, "Utilization of the Lidgerwood System of Logging," *PPLC* (Vancouver 1911), 58; T. Jerome to C & C Lumber Company, 15 February 1916, Box 6, M & R Records, Acc. 726-4.

The reports of other coastal operators reveal implementation of skidder systems under similar topographical conditions. Charles Stimson of the Ballard Lumber Company reported in 1909 that their new Lidgerwood was logging on "comparatively level ground." When R.W. Vinnedge introduced his North Bend system at the 1913 Congress he bemoaned the passing of the easy logging shows but referred to the terrain at his operation as "slightly broken, but on the average good." Finally, H.B. Gardner concluded in 1916 that the Lidgerwood was most efficient "where the ground is not too rough." While the unit functioned well on level ground and up-hill hauls, one could not expect satisfactory performance "on rough ground." In fact, the sole exception to the pattern of these early reports was the English Lumber Company, which set up its Lidgerwood on "very rough, steep ground."[63] The 1916 Pacific Logging Congress was devoted primarily to discussion of high-lead yarding, and the comments of operators and managers reflect similar conditions. F.C. Riley of the Bloedel-Donovan Lumber Mills explained that the procedure was suitable for yarding up-hill or on "reasonably level ground," and James O'Hearne, manager of the English Lumber Company, recommended high leading for timber "standing on the level or where it can be yarded up a slight incline."[64]

Clearly, then, the environmental interpretation fails to provide a satisfactory account of the adoption of overhead logging methods. In ignoring the importance of the class relationship, students of the industry have neglected a vital factor of which operators themselves were all too conscious. When timbermen offered explanations of the advantages involved in overhead logging they emphasized the inherent superiority of these systems, citing 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.

The fundamental superiority of overhead logging was reflected in the balance sheet. During a two-year period the Merrill and Ring Lumber Company's logging cost with skidders was one-third less than with the ground-lead operations conducted concurrently. Other comparisons of the high-lead system with ground yarding reflected a similar reduction in costs.[65] In order to comprehend this quantitative gain, however, it is necessary to focus on the dynamics of the

[63] Charles Stimson, "Adoption of the Lidgerwood Skidder System in Fir Logging," *Timberman*, 10 (August 1909), 57; Gardner, "Ground Skidder or High Lead," 13; R.W. Vinnedge, "A Composite Flying Machine," *PPLC* (Spokane 1913), 10; E.G. English, "Cableway Yarding System, Its Efficiency in Difficult Logging Operations," *PPLC* (Portland 1910), 28.

[64] F.C. Riley, "The High Lead," *PPLC* (Portland-Grays Harbor 1916), 11; O'Hearne, "Description and Value of High Leads," 12; see also W.D. Anderson, "The Story of Log Transportation," *BCL*, 8 (August 1924), 91.

[65] Merrill, "Utilization of the Lidgerwood System," 58; Ronald MacDonald, "High Lead and Ground Yarding Compared," *PPLC* (Portland-Grays Harbor 1916), 11; Robert Waddell, "Ground Works vs High Lead Logging Systems," *WL*, 13 (July 1916), 41-3.

production process. Because aerial systems permitted longer yarding distances, over 2,000 feet in extreme cases, operators benefitted from a reduction in railroad construction expenses. In addition, cable and rigging had a longer life, as the constant jarring and shocks experienced in ground yarding were reduced. But the fundamental advantage of these systems lay in their capacity to restructure timber capital's relationship to the environment, and in consequence, with workers.

So long as yarding took place in direct contact with coastal terrain ultimate control over the pace of production had rested with loggers. By permitting logs to be yarded while partially suspended, overhead systems fulfilled the potential of mechanization. One manifestation of timber capital's new control was a reduction in direct labour costs. As log preparation was no longer necessary, the services of swampers, snipers, and barkers were dispensed with; these men were now on an "eternal vacation." More reflective of the shift in the character of class relations was the operator's unprecedented ability to transform the potential of human labour power into work. R.D. Merrill boasted that the Lidgerwood moved logs through the air at two to three times the speed permitted by ground yarding. The rate at which rigging was returned to the crew was also accelerated; the haulback speeds on Frank Lamb's early cableway system were claimed to be twice that of the ground yarder. Machine pacing, the essence of the factory system, had come to coastal logging.[66]

In ground yarding, Lamb explained, an experienced crew working on level terrain might bring in an average of 30 logs per day, but the time actually consumed in yarding each log and returning the chokers to the woods was not over eight minutes per log. Only four hours a day, then, was actually devoted to yarding. Under the overhead system, however, 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." For Lamb, R.W. Vinnedge and other operators, overhead logging represented a "solution to the yarding problem," marking the end of the "necessity for an endless shifting of chokers and pulling of lines to permit one, and seldom over two logs to bore a tortuous path through acres of stumps and debris." Vinnedge's North Bend Lumber Company was now able to transport up to six logs to the landing at one time, "with seldom a stop after the go-ahead whistle."[67]

Clearly, much of the discontinuity that had marked ground-lead logging was eliminated. Routinization was accompanied by an equally significant deskilling of loggers. Machinery manufacturers and operators may have been prone to exaggera-

[66] "The Evolution of Coast Logging," 23; Merrill, "Utilization of the Lidgerwood System," 55; "The Lamb Cableway System," 47.

[67] "The Lamb Cableway System," 47; Vinnedge, "A Composite Flying Machine," 9; see also Victor Stevens, *The Powers Story* (North Bend 1979), 69; R.J. O'Farrell, "The Evolution of Logging — Some Personal Glimpses," *University of Washington Forest Club Quarterly*, 8 (Autumn 1929), 15.

tion, but their testimonies reflect undisguised enthusiasm about having reduced their dependence on loggers' skills. Lamb pointed out that his system required only two "high priced men," the hooktender and the donkey engineer. The line horseman, chaser and riggingman were replaced by "cheaper men." Overhead methods, declared another writer, diminished the control exerted by the hooktender, "upon whose caprices hangs the day's output." These claims are borne out by the recollections of Sid Smith, a British Columbia veteran logging manager. According to Smith, the high-lead system "took away the necessity of having good chokermen and rigging slingers." Overhead systems also undermined the hooktender's skill and authority. Smith, who was a superintendent for Bloedel, Stewart, and Welch when that firm made the transition to high lead logging, recalled that the company had to fire veteran hooktenders because of their resistance to the new system.[68]

The development of multigear donkeys capable of higher speeds contributed to a further acceleration in the pace of yarding operations. Manufacturers had met with limited success in their efforts to design a two-speed engine for ground yarding because of a tendency for the log to stop when the gear change was made, causing damage to equipment. Overhead logging eliminated this impediment, and in 1917 the Willamette Iron and Steel Works introduced the first two-speed donkey which supplied power for the initial pull and a second gear to permit higher speed after the log was suspended.[69]

By the early 1920s demand was heavy for the two-speed machines being manufactured by the region's equipment companies at a cost of around $10,000.00. Operators were eager to invest in these donkeys, as a Willamette permitted line speeds of 750 feet per minute with a turn of logs. A two-speed model manufactured by Vancouver's Albion Iron Works, concluded logging engineer H.H. Baxter in 1924, if "crowded to capacity," was capable of much higher production than a less sophisticated unit.[70]

Faster yarding speeds led to a change in logging methods. Cold decking involved the use of donkeys to yard logs to a central point where they were piled into a huge pile or "cold deck." From this point they would later be swung to the landing by a large skidder, reducing railroad construction expenses and permitting

[68] "The Lamb Cableway System," 47; "The Evolution of Coast Logging," 22; S.G. Smith, interviewed by C.D. Orchard, Orchard Collection, 8, BCARS.

[69] *Willamette Logging Machinery* (Portland 1925), 30; "New Two-Speed Yarder Developed by Willamette Iron and Steel Works," *WCL*, 35 (October 1918), 22.

[70] E.R. Orr, Vancouver Machinery Depot to G.P. Melrose, 7 December 1922, Roll B-3229, File 040071, British Columbia Department of Lands Records, BCARS; A.G. Labbe, Willamette Iron and Steel Works to Central Coal and Coke Co., 16 December 1921, O-A Records, Box 2; "Progress in Popularizing the Two-Speed Yarder," *WL* (August 1921), 80; James T. Larkin, Western Loggers Machinery Company, to C.E. Davidson, 27 August 1926, O-A Records, Box 1; H.H. Baxter, General Report on Britannia Mining and Smelting Company Ltd., Logging Operations, 22 April 1924, Box 15, Britannia Mining and Smelting Company Records, BCARS.

more intensive use of labour power. The Oregon American Lumber Company purchased two of these geared machines in 1923 and a third the following year rather than extend a railroad spur on their operation.[71] By 1927 Oregon American managers had decided that the remainder of the company's conventional donkeys were obsolete because the skidder and its large crew were not working to full capacity. "With the distance necessary to yard," argued superintendent C.E. Davidson, "it is impossible to keep the skidder busy...on account of the slow line speed of the yarder." He estimated that the most advanced two-speed donkey, which by this time cost nearly $16 thousand, would increase skidder production by at least two rail cars per day. Company officials authorized this purchase, and then another in 1928 after determining that the production increase was double that which had been anticipated.[72]

A change in the fuel source for steam donkeys during this period, involving the substitution of oil for wood, contributed in several ways to the operators' efficiency drive. Oil-fired steam donkeys possessed at least four advantages over those fired with wood. The elimination of wood buckers and firemen reduced labour costs, valuable timber was saved for the market, yarding speeds received another boost, and because oil produced less sparks than wood, the risk of fire was diminished.

First demonstrated at the 1910 Pacific Logging Congress, units for converting steam donkeys to fuel oil were soon being installed by the Loggers Oil Equipment Company. The Merrill and Ring Lumber Company investigated the conversion of their skidders early that year and proceeded with installation immediately. In July, Tiff Jerome reported their performance as "very satisfactory" in that "we have been able to do away with a fireman and woodbucker for each machine." Although the cost of oil was commensurate with the wages of displaced workers, merchantable wood previously used to fire engines now reached the market. These concerns also motivated the St. Paul and Tacoma Lumber Company to introduce oil-burning equipment in the early 1920s. "When you take into account the fire risk, labor...and the amount of wood used," superintendent A.P. Ledoux wrote, "we believe oil is the cheaper fuel."[73]

Oil possessed the additional advantage of permitting intensive operation of equipment. Operator R.S. Shaw responded to the Oregon American Lumber Company's inquiry by stressing the faster yarding permitted by oil: "when the logs

[71]W.H. McGregor to F. Schopflin, 28 November 1923; C.E. Davidson to Schopflin, 22 August 1924, Box 2, O-A Records.

[72]C.E. Davidson to J. Greenman, 22 September 1927; Davidson to Greenman, 28 June 1928; Greenman to C.S. Keith, 30 June 1928, Box 1, O-A Records.

[73]Tiff Jerome to R.D. Merrill, 28 February 1912, Box 23; Tiff Jerome to Craig Mountain Lumber Company, 24 July 1912, Box 4; W.J. Chisholm to Loggers Oil Equipment Company, 28 January 1913, all in Box 4, M & R Records, Acc. 726-4; A.P. Ledoux to Oregon-American Lumber Company, 7 July 1923, Box 2, O-A Records.

are coming fast it is possible to crowd the steam with oil much more than with wood." R.D. Merrill seconded oil's superiority in the application of "full steam" for yarding, and Judd Greeman of Oregon American reported in 1928 that their oil-burning donkey "never lost a minute's time for steam." Moreover, machine and crew time was no longer wasted hauling logs to the landing for use as fuel.[74]

The efficiencies provided by overhead logging, it must be acknowledged, did create a new aristocrat of the woods — the high rigger. This worker's task was to climb the chosen spar tree, taking the limbs off along the way. When he reached the appropriate height, somewhere between 75 and 150 feet, the tree was topped. The necessary blocks and cables were then raised into position on the tree and attached. Finally, when guy lines were fastened to surrounding stumps, logging could commence.

No photographer's visit to a coastal logging operation was complete without a shot of a high-rigger at work, and it is the image of these men which dominates the perception of work in the western woods. The occupation of high-rigger, while perhaps not as dangerous as other less glamorous jobs, seems to represent the courage and rugged individualism associated with the industry. 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 labour process. 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 analogous to that of a skilled maintenance worker. 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 occupation. Firms with holdings sufficient 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.[75]

[74]R.S. Shaw to Oregon-American Lumber Company, 2 July 1923, Box 2, O-A Records; R.D. Merrill to C.L. Ring, 1 April 1924, Box 52, M & R Records, Acc. 726; J. Greenman to C.S. Keith, 21 March 1930, Box 5, O-A Records.

[75]See Spencer Miller, "The Overhead Cableway Method of Logging," *WCL*, 48 (1 August 1925), 41-4, 48-9.

Victoria Lumber and Manufacturing Company high rigger at Cowichan Lake, Vancouver Island. Photograph #78260, B.C. Archives and Records Service.

High rigger topping spar tree. Photograph #73645, B.C. Archives and Records Service.

R.D. Merrill was probably one of the first northwestern operators to express an interest in the steel-spar skidder, which 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. Other firms were attracted by this feature. An Oregon American Lumber Company manager pointed out that with the steel spar "you have practically no rigging ahead to do...when you finish one setting you can go to another and go to work."[76] Late that year, Merrill sent the firm's logging superintendent to Minnesota and Louisiana to watch such machinery at work. The superintendent was "very favorably impressed" with its performance, but for unknown reasons the company did not proceed with the purchase immediately. 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.[77]

The Lidgerwood company began advertising the steel-spar skidder for coastal use in 1914, and by the mid-1920s several of the largest firms had purchased these units. The machines, which cost approximately $50 thousand in 1923, were reportedly capable of hauling speeds of up to 1,000 feet a minute, and had an advertised daily maximum output of 250 thousand feet. The steel-spar skidder represented an extension of the control inherent in aerial logging, freeing companies from the need to locate 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 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." Production was increasingly a case of purchasing and repeatedly establishing complete harvesting systems which gave firms unprecedented control over the environment and workers.[78]

How did loggers respond to the introduction of overhead harvesting systems? Once again, evidence is fragmentary, but it suggests that the hostility hooktenders felt toward overhead logging was shared by other workers. The high speed at which logs and rigging now travelled not only brought greater regimentation to the labour process, but also made logging one of the most hazardous of industrial operations. Loggers at the Merrill and Ring camp expressed their resistance in the usual fashion, by quitting. Although very satisfied with the performance of their skidder obtained in 1909, the company immediately experienced "trouble in keeping a crew." Finnish loggers were the most adept at operating the new system, but as it was "almost impossible to keep Finns," the firm began hiring them for railroad

[76] W.H. McGregor to Frank Schopflin, 1 March 1926, Box 1, O-A Records; R.D. Merrill to R. Polson, 6 November 1913, Box 35, M & R Records.

[77] W.F. MacPherson to T. Jerome, 3 April 1917, Box 216, M & R Records.

[78] "The Steel Spar Log Skidder," *WCL*, 26 (15 September 1914), 32; "The Steel Spar Skidder," *PPLC* (Seattle 1925), 33-5; Paul Freydig, "Why We Bought Four Steel Spar Skidders," *PPLC* (Vancouver 1926), 11-2; Van Tassel, *Mechanization*, 125; See "Skylines and Skidders vs High Lead and Ground Logging," *PPLC* (Portland 1924), 11.

construction work so that a supply of replacements would be available for work on the skidder. This new employment policy was not a success, however, and Tiff Jerome reported that the superintendent was "working in some white men on the skidder" in the hope of eliminating the Finnish loggers.[79]

The Merrill and Ring experience was not an isolated one. The English Lumber Company's manager told delegates at the 1910 Logging Congress that the only shortcoming associated with the firm's new skidder was "the aversion the men felt to working around the machine." Loggers at Weyerhaeuser's Yacolt operation in Washington reacted similarly to the introduction of the high lead system about 1915.[80] How widespread was the resistance to overhead logging? It is to be hoped that further research will provide more insight about this critical issue, but given the paucity of sources it will be difficult to reconstruct workers' response with any degree of certainty. The few references gathered to this point indicate that many loggers did not greet the new technology with enthusiasm.

Further research might also clarify the relationship between the introduction of the new techniques and the labour militancy that erupted in the western woods under the leadership of the Industrial Workers of the World during this period. Wobbly speakers and the *Industrial Worker* frequently alluded to the increased level of exploitation which the "flying machines" brought to woods work.[81] At this point, however, it is an open question as to how the IWW's technological critique related to grievances rooted in hours of work and camp conditions. These were shared concerns, affecting loggers equally, while the response to the introduction of new technology would have been influenced by one's place in the division of labour.

Certainly, there is no evidence to suggest that the examples of resistance to overhead logging cited here slowed the adoption of these systems throughout the industry. While the loggers' individual and collective protest against squalid living conditions in the camps and dawn to dusk work days resulted in gains on both fronts during the 1910s, they had no success in resisting the instruments of production which determined the structure of their labour.

Conclusion

THIS STUDY has approached mechanization from a Marxist perspective which views work as a "relationship of power" involving the exercise of control over

[79] T. Jerome to T.D. Merrill, 4 August 1909, Box 3; Jerome to T.D. Merrill, 5 October 1909, Box 3, M & R Records, Acc. 726-4.

[80] E.G. English, "Cableway Yarding System," 28; Alden Jones, *From Jamestown to Coffin Rock: A History of Weyerhaeuser Operations in Southwestern Washington* (Weyerhaeuser Company 1974), 12.

[81] *Industrial Worker*, 11 June 1910, 1; *Industrial Worker*, 25 June 1910, 1; *Industrial Worker*, 15 February 1912, 1; For a preliminary discussion see the author's "A Dandy Bunch of Wobblies: Pacific Coast Loggers and the Industrial Workers of the World, 1900-1930," *Labor History* (forthcoming).

workers by capital.[82] Logging operators pursued control over production, and power over loggers, to diminish the amount, value and variability of the labour power they purchased. Human labour power, like any other commodity, was to be obtained only in the necessary amounts, cheapened as much as possible and pushed for all it was worth. It was the vision of the factory that drove the process of technological change between 1880 and 1930. In a period of 50 years, the exploitation of coastal forests and loggers had taken on the character of factory production. As huge steam engines and complex rigging systems replaced hand tools and oxen, operators achieved a real measure of control over both nature and workers.

The relationship between lumbermen and loggers was structured in part by competition between units of capital. But operators shared with other capitalists what David Noble terms "an ideological faith in the inevitable efficiencies of reduced skill requirements."[83] Competition in the marketplace proved no barrier to cooperation among firms in what can only be called a unified efficiency drive. Operations may have taken place in relative isolation, but information about technologies was exchanged freely. Operators visited other camps or arranged for their managers to do so, and exchanged correspondence concerning recent advances in harvesting methods.[84] After the inaugural 1909 Pacific Logging Congress they had an annual forum for discussion of mutual managerial concerns. Papers were often presented by machinery company representatives at these gatherings, who brought the latest developments in metallurgy and mechanical engineering into touch with the needs of operators. By the early 1900s the industry had entered the mainstream of North American industrial capitalism in its approach to technological innovation.

The broad impact of overhead logging on skill is clear, if difficult to quantify. While these systems represented a partial attainment of the factory regime harvesting remained marked by discontinuity, and the pace of production depended to a considerable extent upon the physical and conceptual skills of loggers. Overhead systems did allow tracts to be logged profitably that would have defied ground methods, and here the ability to avoid and overcome "hang-ups" was critical. "If not for the ever present human element to contend with," Washington operator R.W. Vinnedge complained in 1922, "the skidder system would yard as many logs on rough as smooth ground." Moreover, the new technology placed a high premium on the ability of a crew to function as an organic production team. Logging, Frank Lamb observed in 1909 "calls for a high order of teamwork," and operators such

[82]Terry Johnson, "Work and Power," in Geoff Esland and Graeme Salaman, eds., *The Politics of Work and Occupations* (Milton Keynes 1980), 335.
[83]David Noble, *Forces of Production* (New York 1984), 36.
[84]R.D. Merrill to S.A. Stamm, 26 June 1933, Box 12, M & R Records, Acc. 726; T. Bernard to J. Greenman, 11 September 1926, Box 1, O-A Records; L.T. Murray, interviewed by Elwood R. Maunder, 1957, Forest History Foundation, University of Washington Libraries, 12.

as R.D. Merrill were well aware of the importance of having "men in the crew that are accustomed to working together."[85]

It would be an error, then, to suggest that coastal loggers were utterly subordinated by sophisticated technologies. Managers continue to bemoan the fact that "the logger exerts a large influence on the volume of production because the man, not the machine, is the controlling factor in the woods." The forest, an operations research enthusiast remarked in 1973, remained a "hostile environment...defined by a large number of variables" which set logging apart from the "relatively controlled environment" of manufacturing plants.[86] But it would be a distortion of equal magnitude to underestimate the impact of the industrial revolution in west coast logging. Mechanization and related changes in the division of labour reduced timber capital's dependence upon the physical and conceptual skills of loggers, confirming the general thrust of Braverman's degradation of work thesis. Both the task range and discretionary content of occupations were narrowed as functions shifted from workers to machines. Certainly by 1930 the yarding of each log represented less of an individual problem to be "solved" by the yarding crew. High-lead logging "isn't exactly an assembly line," wrote journalist, historian, and former logger Stewart Holbrook in 1938, "but it's all routine." Logging operations had indeed come to resemble "a giant factory without a roof."[87]

[85]Vinnedge, "Overhead Yarding Systems," 14; see also A.P. Hennegan, "Fighting "Hang-Ups" in High Lead Yarding," *BCL*, 15 (April 1931), 19-20; Frank H. Lamb, "The Principles of Labor Maintenance," *PPLC* (Seattle 1917), 31; R.D. Merrill to J.R. Benjamin, 12 June 1918, Box 28, M & R Records, Acc. 726.

[86]Thomas G. Wright, "Is the Loggers' Role in Forest Management Fully Recognized," *BCL*, 50 (November 1966), 18; R.M. Newham, "Process Control in Forest Harvesting," *Forest Chronicle*, 49 (February 1973), 35.

[87]Stewart H. Holbrook, *Holy Old Mackinaw: A Natural History of the American Lumberjack* (New York 1945), 184. In focusing on the class relationship this paper has not addressed the ecological consequences of mechanized logging. Readers with an interest in this subject should consult Richard White, *Land Use, Environment and Social Change: The Shaping of Island County, Washington* (Seattle 1992), 94-112; William G. Robbins, "The 'Luxuriant Landscape': The Great Douglas Fir Bioregon," *Oregon Humanities* (Winter 1990), 2-7. For discussion of the impact of exploitation technologies on the forest environment and the failure of the British Columbia state to regulate logging methods in the interests of community stability see Richard A. Rajala, "The Receding Timber Line: Forest Practice, State Regulation, and the Decline of the Cowichan Lake Timber Industry, 1880-1992," in Peter Baskerville, ed., *Canadian Papers in Business History* 2 (1993), 179-209; or Richard A. Rajala, *The Legacy and the Challenge: A Century of the Forest Industry at Cowichan Lake* (Victoria 1993).