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Working the Land *Production Relations in Logging and Reforestation*

Nature and Flexible Production

Logging and reforestation share the distinction of being the only segments of the forest industry in which production takes place in the woods. In the Douglas-fir region, it is also common for logging and reforestation to be conducted as separate operations, with arms-length, contract relations of production connecting the mills to work crews in the woods. This is true even of some of the industry's largest and otherwise most vertically and horizontally integrated firms, including Weyerhaeuser and Willamette Industries (now combined). In this chapter, focusing specifically on the state of Oregon, I explore why logging and reforestation are so often pursued by means of relatively arms-length industrial labor relations. Drawing on agrarian political economy, and specifically Ted Benton's notion of the "ecoregulation" of labor processes in nature-centered activities,¹ I examine alternatives to fixed hourly wage relations as strategies for achieving production flexibilities inspired by the "in situ" character of production in logging and reforestation. Specifically, I argue that variability, risk, and uncertainty associated with the intimate engagement of social and ecological production in logging and reforestation create problems in predicting and rationalizing rates of production in these sectors, prompting capital to seek ways to displace risks and uncertainties while inducing rationalized production.

In this chapter, in keeping with a main theme of the book, I explore the intersection of and disjunction between social and ecological production, specifically through the lens of labor processes and production relations in logging and reforestation. Yet I stress that although the confrontation between social and ecological production explains why many firms prefer to offset certain risks and uncertainties in production, it does not sufficiently explain how particular

social relations, including contracting out and piece wages, develop. This is the realm of politics, contingency, and history. Thus, in my account of social relations in logging and reforestation, I examine structural issues—specifically the confrontation between social and ecological production in logging and reforestation—and how human agency and contingency—specifically the politics and particulars of logging and reforestation labor markets—operate in dialectical relation with one another.² If I give short shrift to the agency of workers to contest relations of production here, it is because for the most part resistance to date has not held back the spread of contracting in logging, and contracting, piece wages, and the exploitation of immigrant workers in reforestation. I do not intend to suggest, however, that such effective resistance cannot or will not develop; quite the contrary. It is my hope and faith that it will.

Confronting Nature in Logging and Reforestation

There is a considerable literature on contract production networks under late capitalism. Such networks—specifically their apparent resurgence—underpin notions of post-Fordist production systems and are critical to debates over the dynamics of social power in contemporary industrial economies. Many explanations of contracting have been offered. For example, contracting has been linked to the development of “leaner” production systems; that is, stripped-down operations that capitalize on a firm’s core strengths.³ Transactions cost theory has been used widely to explain which activities are contracted out and which are not, based on neoclassical ideas of cost minimization and, ultimately, on Ronald Coase’s well-known contrast of vertical integration (make) and market transactions (buy) as alternative firm strategies.⁴ And in particular, transactions costs have been invoked to address internal and external economies of scope.⁵ At the same time, the proliferation of contracting has been tied to possibilities opened by new information technologies, allowing better just-in-time coordination of supply chains over increasingly far-flung production networks.⁶

In this context, the efficiency of specific regional contracting systems has been theorized in terms of capturing knowledge economies within dense networks of localized competing contracting firms and their contract suppliers. Repeat contracting and negotiated prices among parent firms and contract producers who gain familiarity with one another is a noted aspect of the geography of numerous manufacturing districts. Michael Storper explained these regional networks of input-output relations based on so-called “untraded interdependencies.”⁷ Specialized contractors familiar with the needs of contracting firms compete in markets that occupy a space between pure, open competition and vertical integration or formal partnerships. One of the main reasons for some degree of continuity and loyalty in these regional systems of contracting stems from the development of knowledge economies and trust. Knowledge

economies vis-à-vis specific production processes develop through repeat contracting between firms, and this knowledge can improve quality while also simplifying negotiations and reducing transactions costs. At the same time, repeat contracting builds trust, which is central to efficient markets.⁸

The flexibility literature thus offers important insights about the comparative efficiencies of contracting, repeat contractor networks, and various and more flexible forms of integrated wage relations. However, the literature generally does not provide an adequate explanation as to why particular activities would be subject to pressures for restructuring and contract production. For example, Alan Scott noted, “Scope effects (i.e., internal and external economies of scope) are ultimately defined by transactions costs, which in turn have both institutional and technical foundations.”⁹ Yet what are these foundations, and how is it that particular activities come to be isolated for potential outsourcing? How is it that some labor processes are designated lean and others “lard”? Addressing this issue requires careful consideration of specific production processes, consistent with a problem-oriented approach to industrial organization.¹⁰ In logging and reforestation, this requires addressing what I refer to as nature-centered production.

Although very little of the flexibility literature deals with natural resource or nature-centered activities, some research has addressed industrial restructuring and the pursuit of various forms of flexible production in the forest products sector, largely with a Canadian focus.¹¹ Yet little has been written about logging or reforestation that deals with the question of nature and production relations per se. Because there is a general (if misguided) perception that natural resource industries are the hallmark of economic backwardness, it should come as no surprise that research on the new social economy would generally overlook such sectors.¹²

But there is a strong basis for the argument that nature-based production activities involve certain variabilities, risks, and uncertainties that encourage firms to seek flexibility in production relations. Susan Mann, for instance, specifically argued that agriculture’s nature-centered character presents obstacles to the penetration of agricultural capital. Drawing on Marx and Kautsky, Mann called for an agrarian political economy that emphasizes “how various natural features of certain branches of agriculture can serve as impediments to the efficient use of advanced technology and wage labor.”¹³ One example of such mechanisms is provided by seasonal fluctuations and delays in animal and crop maturation, and crop cycles that extend production time, creating unevenness in the demand for wage labor. These are examples of “timescapes”¹⁴ that place the continuous deployment of capital and labor and the social transformation of production processes in opposition to biophysical nature. They thus provide incentives for agrarian capital to achieve flexibility in production relations by exploiting contract and household labor, passing on the risks of production

variabilities and the impetus to achieve production rationalization with contracts and piece wages. In short, timescapes and other challenges stemming from agriculture's nature-centered character provide a rationale for production relations with what Mann referred to as "a much different complexion than that found in industry proper."¹⁵

Using a very similar logic, Ted Benton argued that agricultural labor processes are examples of what he referred to more generally as "ecoregulatory" activities. He identified four central features of such activities: (1) labor is applied to optimizing conditions of transformation, that is, organic processes, which are relatively impervious to intentional modification; (2) labor is primarily aimed at sustaining, regulating, and reproducing rather than transforming those conditions and processes; (3) the organic character of production shapes the temporal and spatial distribution of social production; and (4) certain natural conditions of production (e.g., water, sunlight) act as the conditions of production and the subjects of labor.¹⁶ Although the development of these kinds of ideas is strong in agrarian political economy,¹⁷ similar thinking may be applied to a range of nature-based industries, particularly with respect to the ways that social relations coalesce.

My argument here is that the pursuit of more flexible production relations in Oregon logging and reforestation comprises specific examples of feature 3 of Benton's typology of ecoregulation. In particular, the difference that nature makes lies in breaking down the regularities typical of factory production regimes by means of a number of decisive disruptions. These disruptions act not to block or prevent capital accumulation per se but to shape and constrain production relations in important ways. Natural obstacles become the vehicles or organizing principles around which firm strategies and organizations coalesce.¹⁸ Specifically contracts and piece-wage relations may be understood as key instruments by which capital imposes discipline and subordinates labor in the context of highly specific "biological and geographic peculiarities,"¹⁹ achieving in the process a form of production flexibility.

Contract Production in the Oregon Logging Sector

The degree of vertical (dis)integration in Oregon logging is an important issue. Despite dwindling supplies of old-growth timber and significant reductions in federal timber sale programs in the region, as of 1997 Oregon led all states in logging employment and value added (see Figure 2.1).²⁰ Although logging accounts for a relatively small proportion of the state's overall employment, it remains important to the state's hinterland, where the forest sector is prominent in many small, remote communities.

In this context, it matters a great deal to many workers, their families, and their communities that there are substantial differences in wages, benefits, and

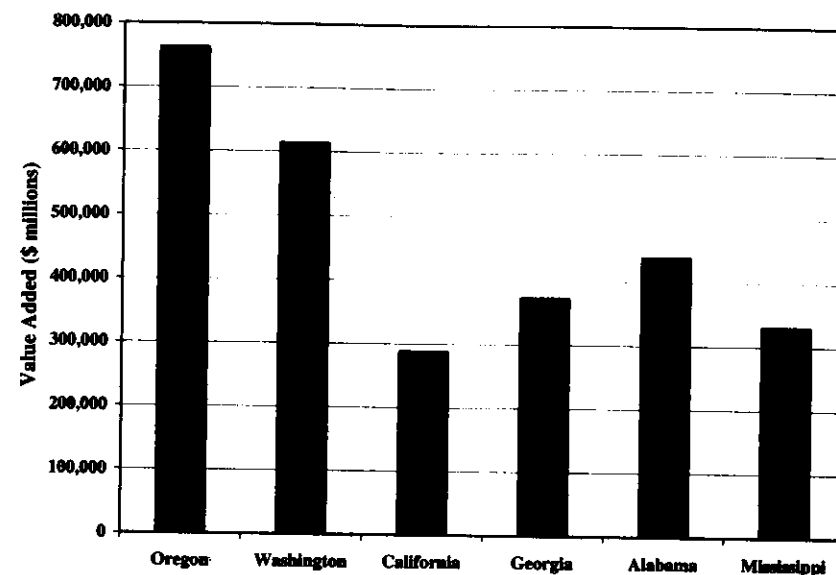


Fig. 2.1 Value Added in Logging in Leading States, 1997. Source: U.S. Department of Commerce Bureau of the Census, 1999.

working conditions when one compares company logging "sides" (crews) with those of the so-called gyppo, independent, or contract outfits.²¹ Although wages are lower on gyppo sides, there are also extreme differences in job security and seniority protections. The character of logging being what it is (i.e., difficult, arduous, and dangerous), there is a premium on youth and skill, and workers deemed too old to work tend to be discarded quickly by contractors. These wage and job security differences in turn are achieved in part because contracting in the Oregon logging sector is virtually synonymous with the use of nonunion labor in the woods; unionized loggers are company loggers, and gyppo loggers are nonunion. Thus if you are an Oregon logger, what kind of a job you have is in large measure determined by whether you work directly for a mill or for a gyppo.

Not only is contracting central to the social distribution of surplus in Oregon logging but at the same time contracting is important because it represents a strategy for firms to manage risks, uncertainties, and rigidities in production. In particular, contracts allow wood-products firms to displace the costs of dealing with these problems onto gyppo contractors and their employees. In this sense, contracts are fundamentally not a meeting of equals in exchange. Rather they are an instrument of power used to achieve flexibility through shorter term commitments to gyppo loggers and, at the same time, to pursue integration and control through specific contract terms, various asymmetries in regional market competition, and differential control of assets.²²

Yet, despite the salience of contract logging, information directly indicating the number of gyppo logging sides versus company sides in Oregon is not available. This is due in large measure to establishment-based reporting in the census of manufactures that does not differentiate between the two types of firm organization. However, data compiled by the Associated Oregon Loggers (AOL), a group representing gyppos, in conjunction with census data and interviews with key industry observers and participants indicate that company crews now account for no more than 10 to 15 percent of the industry, or between eight hundred and twelve hundred employees statewide.²³ The remaining seven thousand to eight thousand workers labor with gyppo outfits. This is not to say that vertical integration between wood commodity production and logging does not exist; it does. Some large firms with substantial regional landholdings, notably Weyerhaeuser and Willamette Industries (before they merged), operate some of their own company crews or "logging sides," as I discuss. Yet the predominant form of organization is vertical disintegration. Although Weyerhaeuser has recently decided to buck the trend in logging and revert to company logging sides entirely, it is significant to the argument I make here that the company has done so on the basis of restructured wage relations that make logging costs more transparent and pass significant production risks along to workers.

The dynamics of contracting become all the more intriguing when one considers that contracting, at least in the Northwest, was not always so widespread. Well into the twentieth century, a large proportion of logging crews worked predominantly in camps operated by lumber companies.²⁴ For example, according to a 1918 U.S. Department of Agriculture report on logging in the Douglas-fir region, the industry was then divided about evenly between independent and company sides.²⁵ However, most of the independents at that time bought land or cutting rights and sold logs to mills. By contrast, contemporary gyppo outfits usually own neither land nor cutting rights and work on a pure contract basis for mills who control the fiber.²⁶ Although Vernon Jensen in his landmark study of labor in the lumber industry noted the existence of gyppos in the Northwest during the mid-1940s, he too stated that the dominant pattern was for logging operations to be integrated with milling.²⁷

Several historical factors may have played an enabling role in the expansion of gyppo logging. First, sawmills increased in average size following World War II (see chapter 4). The resulting centralization of lumber manufacture increased spatial separation between mills and the woods and likely decreased the advantages of integrated operations. Moreover, the onset of gasoline- and diesel-powered trucks to transport logs, workers, and equipment allowed for greater geographic reach and flexibility for logging crews as compared to the more capital intensive and less flexible logging railroads. And road construction and diffusion of the automobile made daily access to the woods from nearby towns much more feasible.²⁸ The chain saw also became increasingly common for

falling and bucking during the late 1940s and early 1950s, decreasing the labor intensity of logging while allowing the fragmentation of large crews,²⁹ which made smaller logging operations economically viable and increased the geographic reach and flexibility of logging.³⁰ Thus, as Michael Williams noted, a whole set of changes in the technology of logging during the 1930s and 1940s "meant that the gyppos could handle all operations from stump to mill nearly single-handed."³¹

Social and Natural Production in Logging

Although these factors describe some of the circumstances under which contracting became more prevalent, they say nothing about why firms would want to use independent loggers in the first place. My argument is that the nature-centered character of logging generates a number of risks and uncertainties by impeding the continuous deployment of machinery and labor, the rationalization of the labor process, and the prediction and regulation of production costs and returns. Specifically, logging presents three basic kinds of ecoregulation: (1) extensive geographies, (2) frequent relocations and landscape heterogeneity, and (3) variable weather. All of these factors confront the continuous deployment of labor, undermine labor supervision, and impede the predictability and rationalization of production. They also contribute specifically to extraordinarily high accident rates in the industry, which, in addition to their human costs, act as obstacles to more rationalized production.

Most logging systems in use in the Pacific Northwest involve an extensive geography of labor deployment that makes coordination difficult.³² In the woods, workers are typically deployed over a wide area and are constantly on the move. In a heterogeneous forest environment, particularly in the uneven topography of the Douglas-fir region, this makes supervision and the imposition of labor discipline extremely difficult. The most extreme example of this is provided by the workers who actually fell the trees ("cutters"). Because of logistical issues and the dangers involved, cutters typically work separately from the rest of the logging crew, often cutting as much as a month ahead. This creates obvious coordination and supervision problems, and many gyppos actually subcontract cutting to independent cutters.

Yet even at the landing site, coordination and control are hard to achieve. Workers must gather or "yard" downed logs to a central area to prepare them and load them for shipping. Once the logs are gathered, they need to be cleaned up and cut ("bucked") into specific lengths, depending on the requirements of different mills. The logs also need to be sorted and graded according to log quality in relation to the specifications of different kinds of mills (e.g., sawmills versus veneer mills) and the prevailing market demand for different kinds of logs (respectively, sawlogs and "peelers"). Finally, the sorted logs need to be

loaded onto trucks for transport out of the woods. These tasks all require a high degree of coordination and the combination of speed and skill on the part of workers. Yet, at the same time, the different jobs on-site must be executed in a maze of downed logs, scrub brush, uneven terrain, and noisy equipment.

Coordinating these various tasks is difficult to achieve from processing facilities because logging sites are typically far removed from the mills. In fact, as wood-processing efficiencies have improved and as scale economies in mills have escalated, transportation costs have declined, making it possible for mills to source timber from greater and greater distances. For example, one mill in Eugene has hauled logs from as far away as Sacramento, California, a distance of more than 450 miles. Although such distances are not typical, the average spatial separation between logging sites and mills has certainly increased over time (see chapter 4).³³ For mills employing their own logging sides, this creates logistical challenges to monitoring and rationalizing production in logging operations.

This problem of extensive geographies is only compounded by inconstant geographies. Because commercial tree species in the Northwest have extremely long rotation or maturation ages, the distinction between biological production time and labor time dwarfs the seasonal problem in agriculture, with significant geographic implications.³⁴ That is, although logging parallels agriculture's land-based deployment of labor with attendant problems for monitoring and control, logging operations also confront the challenge of relocating on a regular and frequent basis to renew timber supplies.

Not only does frequent relocation exacerbate the labor control problem for capital, it also leads to wide variations in production conditions from one logging site to another. In the uneven terrain of the Pacific Northwest, these variations are significant indeed. Local timber stands vary widely, for instance, in the density of tree growth (measured in either stems per acre or total volume per acre). Species composition also varies considerably, as does the quality of the timber. Even fluctuations in the average size of the trees (diameter and height) matters, because the costs of using machinery to handle logs is generally insensitive to log size (within the range of the machine's capabilities), yet large trees yield a higher relative and absolute volume of merchantable wood from each log (see Figure 3.3). Moreover, each logging site has its own particular logistical challenges (e.g., steep slopes, unstable ground), which can be greatly compounded by increasingly stringent environmental standards.³⁵ All of these variations undermine what James Scott referred to as the "legibility" of nature, and they comprise unpredictable sources of ecoregulation that affect the rate of production in ways that can be quite difficult to assess *ex ante*.³⁶

Although extensive geographies, frequent relocations, and local site variability all present certain challenges to labor monitoring and control and to the predictability and rationalization of production, variable weather creates further

problems. In the Pacific Northwest, the weather is at its worst and most unpredictable in winter, with wet, cold, wind and snow making logging very difficult. In contemporary logging, increasing mechanization has facilitated and also motivated more consistent production. Yet poor and unpredictable weather, particularly at high elevations, continues to depress and render unpredictable the amount of actual production time in the sector and plays havoc with daily rates of output. As one logger noted,

One of the things you are concerned about is the wind. If there is timber around, whether in a partial cut or if there is timber where you are logging, and the wind is coming, that is probably one of the most unsafe areas you can be in. If there is a lot of wind, don't go. You go out there, look around, and crank up the crummy and go home.³⁷

In summer, hot dry spells in the otherwise humid Northwest also can cause delays and interruptions in logging as the result of risks that dry forests will be ignited by sparks from the equipment.

The implications of weather delays include daily and seasonal fluctuations in production and reduced total labor time in the sector. Loggers work fewer days and fewer hours on an annual basis than do their counterparts in other industries, including other wood-products sectors. On a national basis (see Figure 2.2) logging employees worked an average of about 190 fewer hours per year per worker between 1977 and 1992 than sawmill employees, and just more than 300 fewer hours per year than softwood-plywood mill employees. This translates into just less than five fewer weeks and just more than seven fewer

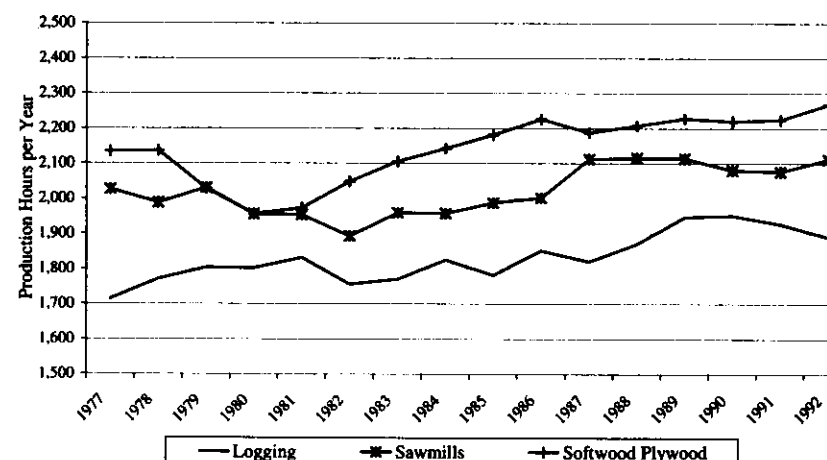


Fig. 2.2 Annual Hours of Production for Workers in Logging, Sawmills, and Softwood Plywood Mills, 1977–1992. Source: United States Department of Commerce, 1995.

weeks, respectively (based on a forty-hour workweek). In Oregon in 1992, loggers worked an average of 1,878 hours per employee, compared with 2,116 hours for sawmill workers, and 2,181 hours for softwood-plywood mill workers. The difference translates into the equivalent of between five and six weeks of work at forty hours per week.³⁸

Fluctuating rates of productivity from site to site and depressed labor time in logging indicate variabilities and uncertainties related to logging's nature-centered character. But no single measure more clearly (and gruesomely) reflects variability and uncertainty in logging than accident rates. High mortality and morbidity rates have long been associated with the logging sector.³⁹ And logging remains arguably the most dangerous of all industries. According to 1995 occupational health and safety data (see Table 2.1), loggers rank behind only commercial fishers and sailors in the frequency with which they are killed on the job. Other occupations with a reputation for hazard—including structural metal work, law enforcement, and farming—do not compare in terms of the risk of death at work. In fact, besides seafaring occupations, only commercial airplane pilots and miners can be considered to be in the same range of mortality risk. In Oregon in 1996, the logging sector accounted for 15 percent of the state's occupational fatalities (nine out of fifty-four) despite accounting for less than 1.5 percent of the state's total employment.

Logging's human toll cannot be attributed to any particular technology or logging system.⁴⁰ Instead, the danger of logging is primarily due to the inherent variability and unpredictability of the work itself; in fact, evidence from around the United States and from other countries indicates that in logging, the main source of danger is actually the timber.⁴¹ Fully 70 percent of the fatal accidents in logging nationwide from 1992 to 1997 resulted from workers' being struck by trees or logs. Moreover, an estimated one-quarter of all logging injuries take place during the actual felling of trees.⁴²

Table 2.1 U.S. Occupational Death Rates by Selected Occupations, 1995

Occupation	Fatalities per 100,000 Employed	Relative Standard Error (percentage)
Sailors and deckhands	115	20.6
Fishers	104	15.6
Timber cutting and logging	101	10.6
Airplane pilots and navigators	97	9.8
Mining machine operators	78	17.5
Structural metalworkers	64	13.6
Farmworkers, including supervisors	30	3.6
Police and detectives, including supervisors	17	3.2

Source: U.S. Department of Labor, Bureau of Labor Statistics, 1997.

Though horrific in their own right, such accidents carry economic costs in terms of production slowdowns, lost labor, wages, health care, and even lawsuits stemming from injury-causing accidents.⁴³ In short, because accidents impact the variability and predictability of production, they comprise one source of risks and costs that are socially distributed in part through production relations, including contracts.

Production Contracts

As a response to logging's nature-centered character, contracts help wood-products firms achieve three things. First, contracts displace onto gyppos the risks of uncertain and discontinuous production generated by extensive and variable geographies. Second, contracts place the onus on contractors (through the explicit or implicit threat of market bidding) to achieve more continuous throughput and enhanced productivity—that is, to rationalize production—in the face of such variabilities and uncertainties. Third, contracts encourage the development of expert, experiential knowledge among contractors about how costs fluctuate across different sites and the incorporation of such knowledge into contract bidding. Although specialized knowledge can and does develop among company wage employees, firms have largely been unable to develop or control this knowledge under conventional wage relations of production. This is because the price they pay for labor is insensitive to variations from site to site in advance of production (i.e., the firms find out that logging a particular site is costly only after the fact), and direct monitoring for the purposes of learning to predict rates of production in advance (as a function of local conditions and to rationalize labor processes in ways that reflect local conditions) is difficult and expensive in the woods, far from mills. By contrast, competitive contract bidding can act as a way of capturing expert *ex ante* estimates of variations in production costs from gyppos.

There is, however, a catch. At least some of the expert knowledge loggers develop is firm specific, driven by geographic and technological factors in the contracting firm's commodity manufacturing facilities and by the specific characteristics of the firm's lands. This can give rise to firm-specific information economies of scale in logging. Thus, two distinct patterns of subcontracting have emerged in Oregon. The first strategy is relatively open bidding, involving more arms-length relations between contracting firms and gypgo logging outfits. This strategy has the advantage of using market competition to rationalize production and to act as a surrogate for expert knowledge by forcing contractors to bid against one another, but it does not allow economies of familiarity to develop. The second strategy, echoing Storper's notion of regional networks linked through untraded interdependencies, involves repeat contracting between mills and gyppos and features much greater familiarity and continuity than

the more open-market strategy. This has the advantage of allowing gyppos to build up specialized expertise that is specific to the contracting firm's production and land portfolios. Not surprisingly, firms opting for the second strategy tend to be larger, horizontally and vertically integrated firms. For these firms, the complexity of their operations generates greater demand for highly specialized expertise.

Risk, Rationalization, and Information

The typical contract arrangement is one in which a gyppo is retained to log timber that is owned by the mill or has been purchased through a separate transaction. Gyppos in turn employ wage laborers who work together on one or more logging sides operated by the gyppo. Workers are predominantly paid on an hourly basis. The contracts stipulate production levels at given locations for fixed prices per volume and grade and are usually (but not always) negotiated between gyppos and the contracting firm.

What these contracts give to the mill is insulation from risk and an associated flexibility in their relationship to logging operations, as well as the capacity to use market signals to generate and track information about logging costs. Management of risk is one of the most commonly identified reasons in the flexibility literature for explaining why firms pursue contracting in many industries, because (1) dense contracting networks can pool and reduce aggregate risk⁴⁴ and (2) large firms can displace risk onto smaller and more vulnerable subcontractors. Typically, the source of these risks is cited as rapidly changing or fragmented market conditions.⁴⁵ However, in this case, the risks involved are not market risks but endemic production risks related to the unpredictability of production costs in logging.

In a regime where the rate of output is so highly uncertain and uneven, production contracts make sense for firms because they allow them to peg their costs only to the timber they receive, displacing the risks (i.e., costs) of uncertain production schedules onto the contractors. By setting the costs prior to logging a site, the firm places a ceiling on production costs and is therefore able to insulate itself from the risks of production slowdowns and cost overruns. With employees paid at fixed hourly rates, these risks are displaced onto the gyppo. In this risk-price regime, contracts also place the burden squarely onto the contractor to impose labor discipline and rationalize production under conditions that impede employee monitoring and make the assessment of production logistics difficult and unpredictable.

Not only do contracts insulate firms from the risk of cost overruns due to site variation but they are also asymmetric with respect to the risks (i.e., costs) of accidents. Contracts allow firms to displace accident costs and restructure risks in several ways. The first of these pertains to insurance costs for workers.

Workers' compensation legislation has generally been structured to socialize accident costs through standard payroll deductions. Because these deductions are in principle indifferent to contract versus vertically integrated social relations, as long as contractors pass their costs to firms, the distribution of accident costs should be indifferent to company and gyppo logging. Yet industry compliance with the requirement that all employees be covered by insurance is not uniform. Despite the availability of pooled insurance among gyppos, insurance costs are still very high. In response, a considerable number of contractors opt for cash wages paid under the table for some or all of their employees.⁴⁶ And this in turn may act to reinforce contracting if gyppo loggers use savings from this practice to suppress contract bid rates.

Second, accidents drive up insurance rates. By contracting for logging, firms displace the risk of escalating insurance premium hikes by linking the higher rates to the contractor rather than the mill. When a contractor's rates increase because of accidents, wood-products firms can avoid having to pay for the higher premiums by shifting to a different contractor with lower rates. In this way, mills use contracts to lower their exposure to the potential costs of accidents.

Third, the use of production contracts preserves an incentive among loggers to "get out the cut" in the face of strong incentives to lower the rate of accidents. That is, insurance premiums tied to accident rates combined with fixed wages or salaries create an incentive in company crews to increase safety even at the expense of production. By contrast, use of contractors allows firms to have it both ways. Gyppos face a cost price squeeze, because they pay insurance rates that rise in proportion to the number of accidents, but they pay wages on a strict hourly basis and receive contract prices that are fixed to volume alone. If the gyppos push the workers too hard, they will save on wages and receive higher profits from volume-based contracts but exacerbate the risk of accidents and thus production delays and higher insurance premiums on subsequent jobs.

Contracting out for logging also takes advantage of information economies generated by market competition among gyppo contractors. That is, production contracts have the advantage over conventional, integrated wage relations of allowing firms to capture expert knowledge among gyppos through contract bidding. Variation in the rate of production owing to topographic variation and changes in forest types (age, species, density, etc.) can be translated into more or less accurate *ex ante* assessments by knowledgeable, experienced loggers. This type of knowledge and information (i.e., conception) is very difficult for the vertically integrated firm to capture, even with careful accounting for the rates of production and costs within each division of the firm. This is because conventional fixed wage and salary employees do not bid for jobs based on their specialized knowledge, nor is there any indication when the job is done of how actual costs and potential costs compare because of wide variation in local

conditions. By contrast, competitive contract prices reflect expert assessments of the costs of logging a site and the value of the timber. The point here most emphatically is not that mills are unable to measure the costs of their company logging operations. They clearly do so. They also know the value of the timber coming from each site and can therefore perform detailed *ex post* calculations of profit rates for each site and, for that matter, for each logging side. But, translating this knowledge into *ex ante* assessments of logging costs is impeded by natural variability from site to site. In turn, this impedes prediction of how the costs of logging each site will vary, which in turn impedes systematic rationalization of on-site production.

Of course, contractors do not report actual costs to the mills either. However, they do bid for contracts in markets that place downward pressure on logging prices. Mills may therefore rely on market competition as a check on inflated logging prices and as an indirect way of capturing an expert logger's ability to "read nature" as a form of information or knowledge. The combination of this expertise with the incentive to apply expert knowledge to improving on-site efficiencies propels a drive for contract relations in Oregon logging.

The Practice of Contracting: Nontraded Interdependencies and Repeat Contracting

If production contracts help mills offset various risks and uncertainties, induce rationalization, and capture expertise through contract bid markets, the expert knowledge contractors develop can also to some degree be highly specialized to the mix of lands and manufacturing facilities held by particular integrated forest products companies. This leads to information economies of scale between contractors and larger companies. Precisely because of these information economies, many contract relations between wood commodity firms and gyppo contractors do not conform to an ideal type of arms-length transaction; that is, open bidding with the contract awarded strictly according to price. Instead, numerous firms practice repeat contracting.

A significant number of Oregon firms do indeed simply announce jobs and accept the lowest credible bid (e.g., Seneca Forest Products in Eugene). Yet numerous prominent firms do not. Instead, some firms work with a set group of contractors to whom they offer jobs and accept the lowest bid (e.g., Roseboro Forest Products in Eugene, and Roseburg Forest Products of Roseburg).⁴⁷ This strategy maintains competitive relations among a subset of gyppos but also encourages familiarity between the parent firm and the contractors, encouraging the development of information economies of scale in their interactions. Other firms retain gyppo loggers on an annual basis and maintain an implicit understanding with contractors that relationships will be renewed (given sufficient work) in the absence of any truly competitive bidding. In these cases, it is very

common for job prices to be negotiated between the wood products firm and the gyppo(s). Although such practices deviate from an ideal typical open and blind bidding process, they do so in ways that further reflect attempts to manage information economies in the logging industry that have much to do with its nature-centered character.

In logging, knowledge of a wood-commodity firm's particular needs combined with the degree of trust that accumulates through past performance creates a niche for gyppos with experience working with particular firms. One logger summed up why Willamette Industries—one of the firms with the largest land base in the state—typically works with a small group of contractors with the following anecdote:

[Willamette has] a loyal commitment. It is good for them. Like this year, they were complaining that their cutting costs were too much. So they got some cutting contractors and they got a cheap rate, so that they could use the leverage on the few cutters they already contracted with. You know "we can get it done for this rate." Well it kind of backfired on them. They ended up with the best job that was available this year and got a cheap rate. Well, they've got special ways that they want their job done. And it turns out that the contractor didn't have enough people to do it, so he hired people and he got lower quality people, people that weren't familiar with the lengths and what they wanted [in terms of] diameters and grades, and they'd send somebody for a couple of days and then somebody else for a few days. So it is a major headache. And [Willamette's] quality control guy has got to keep going back and he's not getting what they want, and here's the best job and the best timber and it's getting butchered out there. You know, it wasn't worth [it].⁴⁸

A specific aspect of specialized knowledge stems from the interaction between variation in the forest and the ways that each wood-products firm chooses to deal with such variation. The issue here is that logs vary in quality not only from site to site but also at a given site. Yet specific knowledge can be accumulated about a particular firm's lands (e.g., tree age, species composition, spacing, location, etc.) and about how the firm wants the lands managed. Compounding geographic variation in the woods, each wood-products company has its own particular way of sorting and processing logs according to its mix of production facilities in the area and the relative strength of the parent firm's margins in its nearby mills. That is, not only does the geographic distribution of each firm's plants vary but some firms profit more from plywood than lumber, others the reverse, and so on. Different kinds of logs (i.e., species, size, wood density, prevalence of knots and other flaws) are generally suitable to different kinds of processing, yet such decisions are to some extent a function of a particular

company's mills, specialization, and market position. The specialized knowledge required to sort logs to suit the company develops among employees through extended employment with a firm and gyppos who contract repeatedly with the same company. But manufacturing firms cannot expect the same of gyppos if they are retained through truly arms-length market transactions.

By practicing repeat contracting with known gyppos, in some cases over periods in excess of fifteen to twenty years, firms can help to create and capture specialized knowledge among contractors while maintaining the added flexibility of contracting over wage employment. The merits of this approach to contracting are particularly apparent to large, horizontally and vertically integrated firms seeking to capture economies of scope in log processing. These firms require the most complex and firm-specific information to be assessed by their logging crews. Thus it is telling that the region's two largest and most diversified firms—Weyerhaeuser and Willamette Industries—have been particularly prone to repeat contracting. These firms have the largest landholdings among private forest companies in Oregon, and they also operate a diverse set of wood-processing facilities in the state. For them, repeat contracting in their gyppo logging operations makes sense because the information economies of scale in doing so are much greater than for smaller firms, with little or no land of their own and with only one or two mills to supply.⁴⁹

To Contract or Not to Contract: Weyerhaeuser's Competitive Logging Program

Contract logging is a strategy for achieving flexible production relations motivated in response to logging's nature-centered character, a structural problem for firms to grapple with. Yet contract logging is not a unique solution to the flexibility dilemma; rather, the translation of structural problems arising from ecoregulation into production relations is ultimately contingent, negotiated, and contested within the dynamics of particular contract and labor markets. Indeed, perhaps the best demonstration of the influence of ecoregulation on production relations in logging may be seen in the history of Weyerhaeuser's competitive logging program. Under this program, the company opted to experiment with contracting and restructured wage relations as a strategy for rationalizing its logging operations. The results not only provide a direct indication of how much trouble firms have controlling production costs in logging under fixed hourly wage relations but also substantiate that there is more than one institutional solution in the pursuit of production flexibilities.

One of the problems with fixed hourly wage relations and contracting in the logging sector is that both present obstacles to firms seeking to directly monitor and rationalize production costs in logging. By using production contracts, firms can induce market competition as a surrogate for rationalizing

production, but they cannot directly monitor how the prices they are paying for contracts correspond to production costs. Instead, firms depend on the competitiveness of the contracting market to keep logging costs under control. Yet if contractors make substantial profits on a particular contract, the firm has no way of knowing unless the contractor makes the books available to the firm (which is unlikely). If the local market for contractors is not competitive, the firm faces the risk of inflated contract prices. Firms that pursue more open, competitive bidding processes need not worry as much. But firms that prefer repeat contracting with a small set of gyppos exacerbate the risk of inflated contract prices. Because of this, some of the larger firms consciously manipulate contractor markets to make sure that, as one logger put it, there is "always one more local gyppo than they need to do all the logging."⁵⁰ However, this requires the exercise of considerable market power and manipulation. On the other hand, fixed hourly wage relations do not allow for direct monitoring and rationalization, for the reasons already discussed. Firms can certainly account for their production costs and returns from a given site after it is logged, but they do not know how closely their costs conform to how cheaply the job could have been done, nor does this necessarily help them predict the costs of future jobs. Thus, wood-processing firms seem caught between intersecting dilemmas.

Weyerhaeuser recognized and directly confronted these trade-offs by instituting a system of competitive bidding among contractors and between contractors and company logging sides. In so doing, the firm restructured its wage relations in logging and thereby challenged an industry-wide perception that contracting is always cheaper than company logging.

Weyerhaeuser's attempt to confront and directly monitor the costs of logging dates to the Northwest wood-products industry's labor dispute of 1986.⁵¹ Using weak commodity markets and the collapse of an industry-wide agreement on wages and benefits to press for concessions in collective bargaining, Weyerhaeuser successfully negotiated a \$4 per hour wage concession with its employees and initiated the competitive logging program. Under this program, the company began to set target prices for logging in each of its areas. These prices were offered to gyppos and to company sides based on Weyerhaeuser's estimate of what it should cost to log a site. Company crews were challenged to beat gyppo rates in the same area and to demonstrate that they could compete with the gyppo sides. Existing union contracts fixed the proportion of cutting done by company sides, but the company threatened to replace company sides with more gyppos in the longer term if the gyppos consistently outperformed the company loggers.

The key incentive in the system lay in restructured compensation packages to company employees. In addition to receiving their hourly wages, company loggers were offered performance incentives that guaranteed them any savings generated if they beat the targets. This induced rationalization undertaken by

the company loggers, and at the same time allowed the firm to compare its internal bids or estimates with actual performance. What Weyerhaeuser found was that the company sides routinely beat the targets, often by substantial amounts.

Although the company was not saving money on individual contracts, Weyerhaeuser put in place a system that allowed it to better monitor, predict, and ultimately depress its production costs. Lowering production costs took place with expert-based rationalization among company sides. Although employees received the immediate benefits of beating targets, in the long run the company used the information generated to lower costs by improving management's capacity to estimate production costs *ex ante*. At the same time, the firm created more competitive pressures on its network of contractors; critical because the initially inflated targets were a direct indication of gyppo profit margins. That is, bonuses pointed to contractors whose profits were at least equal to, and likely higher, than the bonuses.⁵² Weyerhaeuser then used information generated by the competitive logging program to improve its estimates and to ratchet down contract prices set in subsequent years.

As the competitive logging program progressed, company crews began to generate smaller and smaller bonuses, while Weyerhaeuser earned a reputation among Oregon gyppo loggers as a company whose contracts offer little hope of generating a profit. Said one Weyerhaeuser logging employee with knowledge of the program,

I don't believe when [Weyerhaeuser] went into this that they realized that their [target] prices were that bad. This is how they found out. The first clue was when the crews were making these fantastic bonuses. . . . I am sure that they figured it out that if they were paying the crews these big bonuses, they were paying the gyppos too. . . . I think the company is getting what they want out of this. I am sure that they realize that they have gotten their logging costs down on both company and gyppo sides.⁵³

Indeed, the program made Weyerhaeuser sufficiently comfortable with its ability to suppress logging costs that the company signed an agreement in 1997 with the International Association of Machinists and Aerospace Workers (Woodworkers Department) to phase out gyppo logging altogether.⁵⁴ Given the prevalence of contracting in the Oregon logging sector, and the fact that Weyerhaeuser is the dominant firm in western North America,⁵⁵ this was an extremely significant development. Critically, the agreement was predicated on the company's continued use of performance incentives to induce productivity improvements. Although the competitive logging program indicates that there is more than one way for capital to address the challenges of nature-centered production in the arena of social relations, it also indicates that there is considerable room for workers and their representatives to contest and shape the translation of

structural obstacles into production relations, in this case with restructured wage relations as an alternative to independent contracting.

Oregon's Reforestation Sector

The ten of us plant about 7,000 seedling trees every day, or about 700 "binos" apiece, enough to cover a little over an acre of logged-off mountainside each. . . . Two or three sideways hacking strokes [with the hoedag] scalp a foot-square patch of ground, three or four stabs with the tip and the blade is buried up to the haft. (Six blows 700 times amounts to 4,200 per day. At five pounds each, that comes to 21,000 pounds of lifting per diem, and many planters put in 900 to 1,200 trees per day). . . . The next tree goes in eight feet away from the last one and eight feet from the tree planted by the next man in line. Two steps, you're there. It's a sort of rigorous dance, all day long—scalp, stab, stuff, stomp, and split; scalp, stab, stuff, stomp, and split—every 41 seconds or less, 700 or more times a day. . . . The ground itself is never really clear, even on the most carefully charred reforestation unit. Stumps, old logs, boulders, and brush have to be gone over or through or around with almost every slash hampered step. Two watertight tree bags, about the size of brown paper grocery bags, hang on your hips, rubbing them raw under the weight of thirty to forty pounds of muddy seedlings stuffed inside.⁵⁶

Ecological and Social Production in Tree Planting

The emergence of the reforestation industry in the state of Oregon is tied to the gradual depletion of old-growth forests and the politics of sustained-yield regulation. Oregon was the first state in the nation to require restocking of cutover forestlands, and when initial efforts by capital to comply using aerial seed bombardment failed (the squirrels were thrilled!), manual planting of seedlings took hold as the predominant methods of industrial reforestation (see chapter 5). And from the start, the distinct logistics of tree planting have affected its social organization. Much like logging, these distinct logistics are rooted in highly variable site conditions and an extremely discontinuous labor deployment schedule, all of which generate similar obstacles to the *ex ante* prediction of reforestation costs at each site and to the systematic imposition of labor discipline and rationalized coordination.

The first problem with tree planting is that deployment of labor is discontinuous and distinctly seasonal, much more so than in logging. Seasonality in Oregon tree planting is driven by the fact that most conifers, including Douglas-fir, are dormant during the coldest months of the year. When dormant, seedlings are best able to withstand the shock of being transplanted from nurseries to clear-cuts. Thus, peak reforestation labor demands in Oregon occur from

January to March. Reflecting this unevenness, workers in forestry services (which includes reforestation workers) in Oregon averaged a total of just 12.2 weeks of employment in 1993, with more than half of the industry's 7,600 workers employed for less than 8 weeks in total.⁵⁷

The second problem in tree planting is the problem of space, as manifest in remote and rotating job locations and in the dispersed deployment of workers. Tree planting parallels logging in that production takes place in the forest, at locations that change frequently and are often quite remote. This creates coordination problems between mills and reforestation sites in direct parallel with those encountered in logging. A further parallel is that deployment of labor takes place on rugged terrain under constantly changing climatic and topographic conditions. Compounding this, workers tend to be widely dispersed at the site. Although there is little need for coordination among reforestation workers (unlike in logging), the inconstant geography of planting makes rates of production difficult to predict, whereas dispersal of workers makes productivity difficult to monitor and rationalize. Because trees are typically dispensed from a central location, it is easy to measure how quickly planters are working, yet the quality of planting—critical to reforestation success—is difficult to monitor; in fact, it is difficult to verify that seedlings are planted at all, a problem of considerable significance on the evolution of production relations in the sector.

There are also parallels between logging and reforestation in the ways that these nature-centered production conditions have been translated into production relations. In particular, a preponderance of vertical disintegration involving contract relations between landowners and tree-planting firms has been evident throughout the industry's history. As in logging, so too in reforestation, contracting out allows landowning firms and public forest management agencies to (1) avoid lasting commitments to tree-planting contractors and their workers, (2) pass along to the contractors the risks and uncertainties derived from constantly changing site conditions, and (3) place the onus on contractors to rationalize the labor process.

Yet, in other ways, production relations in reforestation have shown historical patterns quite distinct from those of logging. Repeat contracting has generally been less common in reforestation than in logging. Moreover, reforestation contractors have tended to rely on highly marginalized workers, with one observer characterizing the industry's workforce as "winos . . . and other poor quality workers."⁵⁸ This contrasts with the relatively more stable employment conditions in logging and, until recently at least, a level of social esteem afforded to loggers unknown to reforestation workers. Highly exploitive and miserable working conditions largely characterize reforestation, with low pay the norm and with extensive abuses, including overwork, denial of benefits, and, most recently, outright refusals by contractors to pay their workers (see below). Short-

term contracts and pronounced seasonal fluctuations in labor demands also have created very fluid conditions, with worker turnover so high that firms have been reported to employ six workers during a season to keep a single planting job filled.⁵⁹ The industry is also somewhat infamous for the elaborate schemes devised by contractors to cheat private companies and state agencies. A central factor in all of this is the underlying remoteness and inconstancy of work, where abuses can take place without detection, combined with the generally low priority placed on reforestation, particularly acute during the earliest years of the industry.

Reforestation is also distinct from logging in the preponderance of piece-wage relations that have been the norm in the industry throughout its history. Piece wages reflect the unique circumstances of work in the reforestation sector. In particular, paying workers by the tree induces quick planting in an environment where more direct coercion is difficult, and also allows contractors to pass some of the risks of uncertain rates of production on to the planters. In this respect, piece wages are like microcontracts at the level of individual workers.

Even with these broad tendencies, however, the regime of contract and piece-wage relations typical of reforestation throughout its history in the Douglas-fir region is not without its own set of contradictions that have helped shape some historical shifts in the industry's organization. Specifically, piece wages are meant to induce worker self-discipline, but in reforestation they also lead to quality control problems. Under piece-wage regimes, employees have an incentive to cut corners on planting technique if this speeds up production and allows them to plant more trees. At the most extreme, workers have an incentive to ditch trees. Here again, the problem of monitoring workers is apparent. Piece-rate production is typically verified at the central point of seedling dispersal. Yet geographically extensive deployment of workers makes monitoring difficult for the contractors, whereas remote locations and rugged terrain afford ample opportunities for clandestine disposal of trees. Bunches of seedlings can be quickly discarded into rivers, streams, and lakes; over cliffs; down rocky crevasses; or under logs and stumps. But these practices obviously affect the success of reforestation efforts, or the lack thereof. In short, piece wages set up a trade-off between the pace and costs of tree planting on the one hand and the success of reforestation on the other. The resolution of this contradiction between quality and speed has shaped the social history of the Northwest's reforestation sector.

The Rise of Tree-Planting Cooperatives

Virtually from the outset, ditching trees became prevalent in the industry, so much so that ditching seedlings without being caught became celebrated among workers as a skill in and of itself. Initially, landowners were motivated primarily

by regulatory and political pressures to reforest, not by direct incentives to grow trees (with some notable exceptions). Thus, they cared only about the number of acres successfully reforested or, more accurately perhaps, the number of acres that appeared to be reforested under the regulatory gaze. Reflecting this, most early reforestation contracts were actually based on the number of trees planted, not on the number of acres successfully reforested; under such a regime, contractors faced an incentive to inflate their planting totals and to turn a blind eye to ditching, and landowning firms did not intervene as long as they were appearing to meet regulatory obligations.⁶⁰ So long as the success of reforestation efforts was largely a chimera constructed from the number of trees apparently planted, contractors and their piece-wage workers were not in conflict with one another. However, with growing evidence of reforestation failures throughout the Northwest during the late 1960s and early 1970s, and mounting regulatory and political pressure on firms and public agencies to improve their results,⁶¹ contractors were compelled to more carefully control their planters. And out of the emerging conflict between contractors and their piece-wage workers, a unique chapter in the region's reforestation sector, and in American labor history more broadly, emerged in the form of the Northwest's tree-planting cooperatives.

The cooperatively owned tree-planting companies were, as their name suggests, collectives formed by tree-planting workers. Specific models differed between cooperatives, and not all workers owned or controlled equal amounts of the operations or shared equally in revenues; still, the tree-planting cooperatives marked a distinct and colorful departure in a wood-products industry generally organized along more traditionally capitalist lines. Although the first of the cooperatives appeared in the late 1960s, they grew to occupy a significant profile in the Northwest during the 1970s (see Table 2.2), and at their peak accounted for as much as 25 percent of the Oregon tree-planting labor force.⁶² The biggest and longest lasting of the cooperatives were southwestern Oregon's Green Side Up and the Hoedads out of Eugene.

These cooperatives offered several advantages over their more conventional competitors, advantages rooted in the peculiarities of tree planting. First, by giving every worker a stake in the company on more egalitarian terms, these firms could more easily retain experienced workers from season to season, a problem given the industry's high turnover and increasingly important with more and more emphasis on reforestation success, and thus worker skill and experience. Second, even while retaining piece-rate wages to encourage and reward individual production, the cooperative firms discouraged shirking—ditching or cutting corners—by giving every employee-owner a greater stake in the overall success of the company. Because every worker doubled as a manager, enhanced quality control and monitoring could also take place in the field among workers who might otherwise ignore and even exult in each others'

Table 2.2 Pacific Northwest Tree-Planting Cooperative Membership, 1972 to 1989

Year	Hoedads	All Cooperatives
1972	30	30
1973	125	125
1974	200	200
1975	250	300
1976	300	400
1977	350	500
1978	325	575
1979	300	650
1980	250	675
1981	200	650
1982	150	600
1983	100	500
1984	30	350
1985	25	225
1986	15	70
1987	30	85
1988	30	85
1989	30	85

Source: Mackie, 1990.

cheating. In these ways, tree-planting cooperatives combined individual productivity incentives with dispersed monitoring costs, making each worker responsible to and for each other. As Rick Herson, former president of the Hoedads cooperative stated,

By being self-employed our labor is much more motivated to [do] quality work than any other segment of the reforestation labor pool. Each person shares in the responsibility of the work. The quality is directly related to the pay and consequently each worker is directly rewarded for top quality work.⁶³

These aspects of cooperative organization played well against the backdrop of increasing emphasis on quality—not just quantity—in the reforestation industry. As standard practice among landowners began to switch in the late 1960s and early 1970s from per tree contracts to per acre contracts, independent contractors were squeezed between growing pressure to ensure restocking success and piece-rate employees whose incentive was hardly to ensure quality and whose ditching of trees had become common. Yet any attempt by contractors to police behavior among workers or switch to hourly wages was confronted with the peculiar nature of tree planting.⁶⁴ Widespread dissatisfaction with low

wages and abusive labor practices in the industry also created strong incentives among the most experienced and skilled tree planters to work cooperatively, drawing some of the industry's top workers to the cooperatives. Thus, despite efforts by conventional contractors to drive the cooperatives out of business, they flourished. Mackie reported, for example, that Hoedads had a reputation for providing the highest quality work in the industry and at the same time could pay members on the order of \$25 per hour and up to \$25,000 dollars per year in 1980, well above industry standards, and it was on the way to converting tree planting into a form of living employment.⁶⁵ Rick Herson of Hoedads, in testimony before a 1977 congressional committee investigating reforestation failures, presciently noted the significance of the tree-planting cooperatives in precisely these terms; that is, as a way to generate living wages in reforestation and to create from tree planting a form of sustainable employment, while also noting,

Co-ops and partnerships are stabilizing an industry that does not have a union to protect its workers from exploitation. This greater stability leads to a better understanding of silvicultural techniques and just what it takes to make a tree grow. A planter armed with his knowledge becomes a skilled technician, not just a stoop laborer. I have planted 250,000 trees in 5 years of tree planting.⁶⁶

Synergies in the Agricultural and Reforestation Labor Markets

Unfortunately, the promise of living wages in the Northwest tree-planting sector introduced by the ability of the cooperatives to reconcile the conflicting imperatives of speed and quality was undone by the emergence of a new phase. Under this new labor market regime, price-based competition in reforestation contracts was reasserted by means of the exploitation of highly vulnerable and marginalized farmworkers. At the height of the cooperative period in 1979, approximately 90 percent of tree-planting laborers were U.S. citizens.⁶⁷ Yet, by this time, evidence of a new labor supply system in the region's reforestation industry was already becoming apparent, as contractors increasingly turned to migrant, predominantly Hispanic, farmworkers. Many of these workers were already in Oregon and other parts of the region to work on farms, including, for example, in the fruit orchards of southwest Oregon and in the rich lands of the Willamette Valley. Others were available for import courtesy of "coyotes" whose existing labor supply networks stretched throughout the region and extended back to Mexico and central America. Capitalizing on the offsetting seasonal peaks of labor demand in Pacific Slope agriculture and tree planting, private, noncooperative reforestation contractors were able to reestablish control of the industry by drawing on a highly marginalized labor force to compete with the cooperatives using cheap labor all on the backs of vulnerable workers.

The exact origins of the use of farmworkers in Northwest tree planting are not easy to identify. Details of this history are not readily available, because of the outright illegality of many of the practices characterizing this labor supply and management system and the extremely coercive conditions under which many of the workers toil; getting anyone to talk about it is difficult. However, in 1974 a Medford, Oregon, reforestation contractor named Robert Felix Gonzalez became the first person in the state to be convicted of employing nondocumented Mexican workers.⁶⁸ Moreover, Immigration and Naturalization Service (INS) records show an increase in arrests of undocumented workers in the Oregon reforestation industry from 112 in 1978 to 249 in 1979, without any increase in staffing resources devoted to the sector. By 1984 the proportion of the Northwest reforestation workforce who were permanent U.S. residents had, according to one knowledgeable observer, dropped to an estimated 30 percent.⁶⁹ And by 1993 an estimated one-half of the industry's workers were undocumented and in the country illegally.⁷⁰ The increasing use of undocumented workers in reforestation during the late 1970s is further indicated (albeit indirectly) by a suspicious drop in prevailing contract costs. Estimates of reforestation contract costs in Oregon by the Bureau of Land Management during 1979 to 1980 showed a systematic tendency to exceed actual costs; agency estimates exceeded actual low bids that year by an average of 23 percent (see Table 2.3). With its high labor intensity, about 80 percent of total reforestation costs are for labor; consequently, the tendency to overestimate costs is very likely a product of plunging wage rates. And these plunging wage rates were tied to increasing use of migrant farmworkers by reforestation contractors.

Some industry observers feel that the exploitation of undocumented Hispanic farmworkers in the Oregon reforestation sector was aided, albeit unwittingly, when the Carter administration ordered the INS to stop pursuing such workers in order to obtain a more accurate census count.⁷¹ However, it is clear that the supply of these workers to reforestation contractors, and indeed the prevailing pattern of labor relations and abuses, is tied closely to the political geography of agricultural labor markets in Oregon, and the U.S. West more generally. Two principal threads connect what might superficially appear to be separate labor markets. First, the heavy reliance of the tree-planting industry on Hispanic workers, documented and undocumented, relies on established populations of Hispanic workers drawn to the state to work in agriculture. In particular, this labor supply relies on established networks of Hispanic labor recruitment delivering documented and undocumented workers for tree planting capitalizing on the offsetting seasonal peak labor demands in the respective industries. Second, the systematic abuses and coercive labor relations that came to pervade Oregon's tree-planting industry drew directly on practices in the state's agriculture sector, also relying on established networks and practices of labor supply and control.

Table 2.3 Estimated and Actual Reforestation Costs on Bureau of Land Management Land for Fiscal Year 1980

Contract #	Low Bid	BLM Estimate	Difference	Percent Error
43	\$70,701	\$109,236	\$38,535	35.28
44	101,090	132,810	31,720	23.88
45	125,919	161,842	35,923	22.20
46	27,510	33,110	5,600	16.91
47	101,554	132,250	30,696	23.21
48	64,000	69,600	5,600	8.05
49	62,460	64,800	2,340	3.61
50	10,428	19,175	8,747	45.62
52	10,416	20,253	9,837	48.57
53	37,888	39,907	2,019	5.06
55	67,712	78,752	11,040	14.02
56	3,526	5,117	1,591	31.09
57	19,800	34,200	14,400	42.11
58	4,836	14,119	9,283	65.75
59	17,100	19,746	2,646	13.40
62	35,000	41,660	6,660	15.99
63	19,575	28,120	8,545	30.39
64	25,200	29,162	3,962	13.59
65	30,400	33,328	2,928	8.79
69	32,000	34,360	2,360	6.87
71	21,731	40,300	18,569	46.08
72	31,360	36,052	4,692	13.01
73	25,700	30,590	4,890	15.99
75	112,970	117,554	4,584	3.90
76	24,800	34,200	9,400	27.49
79	35,866	42,336	6,470	15.28
81	64,986	71,319	6,333	8.88
83	84,730	89,250	4,520	5.06
84	7,830	9,370	1,540	16.44
86	19,740	44,616	24,876	55.44
90	9,600	13,817	4,217	30.52
91	54,280	57,000	2,720	4.77
94	9,585	17,946	8,361	47.59
115	20,625	26,749	6,124	22.89
117	9,150	10,559	1,409	13.34
Totals	\$1,400,068	\$1,743,205	\$343,137	22.87
Average Error				

Source: U.S. Congress House Committee on Agriculture, 1981.

Oregon's reliance on and supply of migrant agricultural labor is ultimately tied to U.S. programs designed to deliver a low wage, flexible (i.e., nonunion, vulnerable) workforce to American agribusiness. It was the *bracero* programs developed jointly by the Mexican and U.S. governments in 1942—in the context of wartime labor shortages—that created an officially sanctioned and orchestrated flow of Mexican agricultural workers northward. Under the *bracero* program, Mexican workers were officially licensed and allowed to work at specific locations under contract to growers in various industries. When the contracts expired, *bracero* workers were required to return to Mexico. Although the program gave an official sanction to the importation of Mexican workers, it also very directly influenced the flow of illegal or nonsanctioned workers into the United States, as agroindustry recognized the advantages of drawing on such a vulnerable workforce. Thus, although nearly four million *braceros* were recorded entering U.S. agriculture between 1942 and 1960, they were accompanied by millions more undocumented Mexican workers.⁷² And although the *bracero* program officially ended in 1964, networks in a new geography of labor supply were by this time well established and able to draw workers in without the official assistance of the U.S. government. Thus, for example, Miriam Wells estimated that noncitizen immigrants comprised 80 percent of the California agricultural labor supply from the mid-1960s through the late 1980s, with about half the total workforce undocumented.⁷³

The *bracero* program initially served California growers,⁷⁴ and the most popular and scholarly focus on the issue of migrant farmworkers has been directed at that state. Yet migrant Hispanic farmworkers have long been important in Oregon's agriculture sector. Numerous state studies conducted during the late 1950s and in the 1960s point to the important role of a generally migratory labor pool for the state's seasonal agricultural labor demands.⁷⁵ Out-of-state migrants comprised an estimated 20 to 30 percent of total seasonal labor in Oregon agriculture between 1958 and 1968,⁷⁶ and Hispanic workers formed a sizable contingent of the interstate workforce. According to the Oregon Bureau of Labor, roughly 25 percent of the total migrant workforce in Oregon in the late 1950s was Hispanic, and about 30 percent of this group was composed of Mexican citizens.⁷⁷

The supply of migrant, and predominantly Mexican, Hispanic farmworkers in Oregon, as in many of the states of the U.S. South and West, was tied closely to networks of contractors and subcontractors who acted as intermediaries between growers and the workers. The contractors and subcontractors managed the supply networks with personal connections and also were able to exploit the vulnerability of foreign workers—many of whom spoke little English—to keep wages low while profiting from supply contracts signed with growers. In their turn, growers were largely pleased to have cheap help, and they turned a blind eye to abusive and coercive practices. At a broader level, the exploitation

of farmworkers was considerably enabled by their exemption from protections (including the right to organize) under the National Labor Relations Act.⁷⁸ As a result of this structure of exploitation, inadequate conditions typically prevailed where the migrants worked, including poor quality housing, the lack of potable water, and the lack of sanitary facilities.⁷⁹

There have been efforts to curb the worst of farmworker abuses in Oregon and in other agricultural states.⁸⁰ Moreover, large year-round populations of Hispanic farmworkers are now established in Oregon, including for instance, in the town of Woodbridge, south of Portland. More permanent settlements and worker and migrant organizing for assistance and social service provisioning have improved conditions considerably. Yet it is also true that although Hispanic farmworkers continue to form a crucial contingent of the state's seasonal farm labor market, they also remain among Oregon's most exploited workers. According to the region's farmworker union (Pineros y Campesinos Unidos del Noroeste), annual average income for Oregon farmworkers stands at \$6,500, unchanged in more than a decade. Moreover, violations of minimum wage standards are still routine in prevailing piece-wage systems. Health care benefits are rare, housing for many workers and their families is poor, nutrition is often inadequate, and many workers are exposed to high levels of harmful agricultural chemicals. These problems are only compounded by the fact that the rights of Oregon farmworkers to organize remain unprotected.⁸¹

The salience of the Oregon farmworker story to the state's reforestation sector is that parallel patterns of labor supply contracting have developed in reforestation, capitalizing on the offsetting seasonal peak demands for labor in agriculture and reforestation. Moreover, some of the same tendencies toward coercive labor practices are apparent in reforestation work. Labor contractors, at least some of whom seem to have gained experience contracting for the supply of migrant farmworkers, have used and extended existing networks of labor supply to deliver Hispanic workers to reforestation jobs. Some of these contractors have participated directly in securing reforestation contracts on either federal or private forestland. But, more typically, separate labor contractors and subcontractors seem to work in tandem with tree-planting contractors. Although the latter secures the contracts with landowners (including the Forest Service and the Bureau of Land Management), the former takes responsibility for labor recruitment and supply. Undocumented workers, preferred by contractors because of their extreme vulnerability, are often brought directly from Mexico or are secured through populations of Hispanic farmworkers already in the region.

Because so little analysis of labor relations in the tree-planting sector has been done, there exists little documentation of the abuses. Yet anecdotal evidence points to exploitation at least as widespread and severe as what has been reported

in connection with agriculture.⁸² Because of the lower profile of reforestation (and thus less attention to the problem of abusive labor practices) combined with the remoteness of work sites and the winter conditions that often prevail, conditions in reforestation might actually be worse. Contracts between workers and their employers are almost uniformly verbal, with wages set on a piece-rate basis. Although federal and state minimum wage requirements stipulate that piece rates must result in the hourly average wage meeting or exceeding the minimum, this often is violated. Some contractors have reportedly required workers to put in ten- to fourteen-hour days, at piece rates that fall short of minimum wage levels and with no extra pay for overtime. Moreover, from such meager wages, the contractor frequently deducts the costs of transportation and food. Although it is illegal for contractors to profit from such deductions, it is evident that they do so by means of charging exorbitant rates. Moreover, workers often are housed and even forcibly detained at remote planting sites for the duration of the contract, living in what can be substandard shelters (sometimes even tents) without proper heat during winter months in the mountains. Potable water and proper sanitation are typically lacking. Despite these conditions, housing costs also may be deducted. At the end of the contract, or perhaps at the end of a two-week pay period, contractors have been reported to systematically violate the terms of their verbal contracts by underpaying workers and by going so far as to report undocumented workers to the INS. The INS then deports the workers, and the contractor can thus avoid payment altogether.

During an investigation into the use of undocumented workers in Oregon's tree-planting sector in 1980, Lane County commissioner Jerry Rust characterized the exploitation of undocumented workers as follows:

They are often arrested and deported before they are paid, to the benefit of the contractor. They are charged exorbitantly for their travel, for their room and board. Oftentimes they find themselves owing their souls to the company store. They have no health or accident insurance and no unemployment benefits. It is even questionable whether the taxes they pay are being turned over to the State and Federal taxing authorities. Since no social security numbers exist for undocumented workers, this abuse is likely to be widespread. To whom could they tell their story? . . . I believe there to be an efficient, well-organized system for bringing undocumented laborers into the Northwest woods to perform contract work. Many undocumented workers have been arrested and deported time and time again.⁸³

In the same session, David Audet, of the Oregon Legal Services Corporation (formed to handle legal issues for seasonal and migrant farmworkers) stated the following:

They are paid by piecework. Oftentimes, though, my clients have just received an absolutely unrelated sum at the end of the job. This is because of what we call improper deductions. The contractor will promise them, let's say \$800. Well, oftentimes the deductions which we are talking about are the gas and oil for the chain-saws, money for rides, money for food, oftentimes money for transportation from Mexico. One of the worst abuses is when the contractors use the person known as the "coyote," who is the person that actually transports the people. This person will bring them up from Mexico or from California and hold them there until they have paid off what they owe them.⁸⁴

Owners of private forestland, including large companies such as Weyerhaeuser and Georgia Pacific, have unquestionably made extensive use of reforestation contractors who in turn employ and exploit undocumented workers. But perhaps what is most striking and appalling about the degree of coercion in the industry is the complicity of federal agencies, including the Bureau of Land Management and the Forest Service. At least since the late 1970s, there have been indications that Forest Service and Bureau of Land Management reforestation contracts were being granted to contractors who employed undocumented workers. Both the Bureau of Land Management and the Forest Service were required until very recently to award contracts to the lowest bidder in blind bidding processes. The reforestation contracts offered by these agencies were therefore susceptible to unscrupulous contractors who could win competitive bids by exploiting undocumented workers and thus suppressing their labor costs. But according to numerous observers, neither agency has been particularly concerned with stopping the exploitation of undocumented reforestation workers. Instead, the agencies tended to ignore labor relations in reforestation as long as the trees got planted. Commenting on the tacit approval given to extensive abuse of workers in the industry, one official noted, "It appears to me that the Federal Government itself through its contracts is quite possibly the largest single employer of undocumented workers in the Northwest."⁸⁵

By all accounts, the INS has become more diligent and even-handed in pursuing this issue, tracking down not just undocumented workers but also contractors who thrive on exploiting and even cheating these workers.⁸⁶ However, a system of labor supply has been established in reforestation, one that relies on poorly paid, vulnerable, and highly exploited workers whose work in the woods is facilitated by at least sixty years of administrative ambivalence to the plight of migrant farmworkers. Until more concerted efforts to organize these workers are facilitated by more exacting labor standards applied to reforestation contractors and the public agencies and private forest products companies who retain them, and until systematic changes put a final end to the hypocrisy that allows immigration law to be used as a tool to exploit workers, these practices

are likely to remain a staple in reforestation work. Moreover, the dream of living wages and sustainable employment for all reforestation workers, hinted at by the tree-planting cooperatives, will remain just that: a dream.

Conclusion

In this chapter, I argued that the intimate confrontation between natural and social production in logging and reforestation constrains the continuous deployment of labor and capital and the rationalization of production in these sectors. The resulting pressure on firms to displace the costs of discontinuous and unpredictable output propels development of social relations with a "different complexion."⁸⁷ Thus, in logging and reforestation, more flexible production relations have developed as responses to ecoregulation; these include restructured wage relations, quasi-arms-length contracting, and piece-rate wages. Production contracts allow firms to pass on risks, and restructure incentives in a production environment where ensuring continuous throughput and labor process rationalization are difficult. At the same time, in logging, repeat contracting between larger, more complex firms and a limited set of gyppos is a relatively common practice, allowing firms to capture expertise gained through familiarity among experienced gyppos and to capitalize on trust that develops over time through repeat contracting. In this manner, ecoregulation not only propels flexibility in logging but also underlies the particular manifestation of Storper's untraded interdependencies, linking firms and gyppos in repeat contracting networks. These same untraded interdependencies underlie Weyerhaeuser's competitive logging program, a different institutional solution involving restructured, incentive-laden wage relations between the firm and company logging sides.

Reforestation is characterized not only by the prevalence of contracting but also by the absence of repeat contracting and the use of piece-rate wages. Although the ecoregulatory rationale for pervasive contract relations of production in the reforestation sector is broadly parallel to logging—including inconstant geographies, unpredictable rates of production, challenges to labor control and rationalization—reforestation exhibits its own particular forms of flexibility, with generally more price-based competition for contracting and less repeat contracting. Moreover, piece wages, common in reforestation but not in Oregon logging, may be understood as microproduction contracts, passing on the risks and uncertainties associated with variable production conditions to reforestation workers. As in logging, so too in reforestation, these broad structural generalities linking contract relations of production to the problems of ecoregulation does not mean that there is only one unique solution to the ecoregulatory dilemma. Instead, at different points in the history of the sector, reforestation cooperatives and highly exploitative employment of migrant

farmworkers represent distinct institutional strategies, with clear normative differences between them.

Thus, although I emphasize the salience of ecoregulation and the problematic conjuncture of social and ecological production in the labor process as an influence on production relations in both sectors, there is at the same time no unique or scripted solution to the problems posed by ecoregulation. Social relations cannot simply be read off of the structural constraints posed by nature-based production. This further underscores that any notion of ecological crisis tendencies in the production of commodities from nature and the commodification of nature must embrace the structural dimensions of these tendencies and also the politically, culturally, historically, and geographically contingent ways in which they are addressed.

3

Industrial Ecologies and Regional Geographies

In the forest products industries, new technologies have offset changes in species availability and growing stock, averting severe dislocations and significant price increases. Technological progress has thus helped keep the "Malthusian" limit on forest resources at bay.¹

Converting raw material inputs into commodities is constrained by the character of resource industries. Because these activities rely centrally on biophysical processes for their inputs, their industrial geographies and technologies are influenced by the timing, location, and quality of raw materials. These constraints are neither invariant over time nor completely resistant to concerted efforts to overcome them. But they are very real influences, despite postindustrial narratives suggesting the conquest of nature's limits.² This is most apparent in extractive industries such as mining in which capital must constantly confront an exogenous geography of raw material availability.³ Yet even in renewable resource sectors, issues such as extensive land requirements and regional differences in natural rates of productivity exert significant influences on the organization of capitalist production. Institutional issues (e.g., property rights, taxation), environmental politics, technological change, and proximity to markets are also important factors shaping industry geographies, yet natural resource processing and conversion must still confront the basic realities of raw material dependence.⁴ Converting timber into wood commodities is no exception.

In the following two chapters, intended as complements to one another, I explore an "industrial ecology" of solid wood commodity manufacture in the Douglas-fir region. By industrial ecology, I mean the relationships between industry geography and organization on the one hand and biophysical nature—including not only raw material characteristics but also environmental impacts