THE IMPACT OF CALIFORNIA'S CHANGING ENVIRONMENTAL REGULATIONS ON TIMBER HARVEST PLANNING COSTS

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Sponsored by

The California Institute for the Study of Specialty Crops

And

The Forest Foundation

March 2005

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Abstract

The primary purpose of this study is to establish basic and supportable information on the impact of environmental regulations on California's forest products industry. More specifically, the study focused on the effects of changing forest practice regulations on timber harvest planning and preparation costs. A survey of wood-processing and forestry consulting firms was conducted in the Summer and early Fall, 2004 seeking data on Timber Harvest Plan (THP) preparation costs, a major component of the transactions cost in California's timber market. Despite the short data collection period, 607 sample observations were obtained.

Analysis of the sample data clearly indicate significant cost increases resulting from ever-intensifying forest practice regulations, especially as a result of rule amendments in the early 1990s. Over the 30-year span, THP costs increased at a compound annual rate of about 4%, above inflation. Around 1993, there was a dramatic increase in these costs as THP costs, increasing nearly 60% within one or two years. As a result, a typical THP costs around $30,000 to prepare today, whereas 30 years ago it cost less than $2,500 (in today's dollars).

But these increases only reflect harvest planning costs under routine conditions. California's Forest Practices Act can force considerable alteration of logging operations, increasing logging costs which in turn reduce economic rents (a.k.a. "stumpage") to timberland owners. Thus, California timberland owners are "squeezed" on both cost and revenue sides. Landowners facing uncompetitive returns from managing their lands for wildland resource values, like timber, are increasingly inclined to sell their land for higher returns. In California this frequently means conversion to housing, a far more environmentally degrading land use. In other words, California's increasingly strict environmental regulations of forestland are, in many cases, having precisely the opposite effect from that which was intended. Well-publicized urban sprawl and urban migration to historically rural areas is evidence of this effect.

Acknowledgments

The authors are grateful for the financial support of the California Institute for the Study of Specialty Crops and also Donn Zea and the The Forest Foundation Board of Directors. The California Licensed Forester Association and the California Chapter of the Association of Consulting Foresters provided valuable help in encouraging its membership to participate with our study. We would like to give special recognition to Kyle Jacobson, a Cal Poly graduate student, and student assistant Meghan Reeves. Their help in collecting data and fostering survey response was invaluable. We thank William E. Kleiner and Jared Tappero for providing additional information on the THP process. Finally we wish to thank Drs. Sean Hurley and James Ahern (Agribusiness Dept., Cal Poly) and Dr. Keith Gilless (S.J. Hall Chair in Forest Economics, UC Berkeley) for their invaluable review of this manuscript. Any errors, omissions or inaccuracies are entirely the responsibility of the authors.

The California Institute for the Study of Specialty Crops (CISSC) was established in July 2003 by a grant from the California Department of Food and Agriculture's By California Initiative Program. Funding for this project has been made available by the Governor's Buy California Initiative, the California Department of Food and Agriculture ("CDFA") and the U.S. Department of Agriculture ("USDA"). The content of this publication does not necessarily reflect the views or policies of CDFA or USDA, nor does any mention of trade names, commercial products and organizations imply endorsement of them by CDFA or USDA.

INTRODUCTION

A popular refrain throughout the United States is that California has the most restrictive environmental regulations of any state, and perhaps the entire world, particularly regarding private timberland (Yee 2003, Morgan, et al. 2004, Dicus and Delfino 2003). California's complex and sometimes conflicting array of federal, state, and local regulations cover essentially all environmental protection issues: forest health, wildlife habitat, water and air quality, archeological sites, land use patterns, and respect for community sentiments (Arvola 1976, Martin 1989). This study attempts to clarify the extent to which California's Forest Practices Act (FPA) serves as an obstacle to timberland owners' attempts to market their products.

California landowners, like those in any other state, must obey federal laws; however, the degree to which those laws are enforced can be asymmetrically applied depending upon land use zoning. For instance, the Clean Water Act is currently more intensively enforced on lands zoned for " timber production" (TPZ) than on agricultural lands. For example, protection of riparian areas on TPZ lands involves essentially a "no-entry zone" (within 100 to 300 feet from the stream's centerline, BOF 2000, PRC Title 14 CCR § 916.5, 936.5, 956.5). By contrast, tilling or grazing practices on agricultural lands have generally been allowed up to or within a short distance of the high water mark, but these allowances may be changing (NCALRI 1999). Further, unlike agricultural activities (even including crop conversions), any commercial harvest of private timber constitutes a "project" under the California Environmental Quality Act (CEQA) which encompasses a host of related state and local environmental regulations.

Purpose

The purpose of this study is to determine the impact of changing environmental laws on transacting the sale of standing timber in California. One of the first and most important obstacles in marketing and harvesting timber involves the preparation of a Timber Harvest Plan (THP), the functional equivalent of a CEQA Environmental Impact Report (EIR). Contractual arrangements between buyer and seller are a function of the normal market factors but have been increasingly affected by California's Forest Practices Act (FPA) requirements.

This study represents Phase II of a longer term study on the effects of environmental regulations on the forest products industry, which is, in turn a, component of a larger effort underway by the California Institute for the Study of Specialty Crops (CISSC) to ascertain these effects on the State's agricultural industry. Phase I of the long-term study compared the State's FPA to certification

programs administered by international organizations to promote sustainable land practices (Dicus and Delfino 2003). Phase III, already underway, will build upon the objectives and methodology of Phase II by analyzing the effects of environmental regulations on operational costs in the forest products industry.

Environmental Regulations and Forestry

In economic terms, government-imposed measures to protect the environment are justified under the premise that net social welfare is increased. This implies that the economic benefits of environmental regulations outweigh the costs. By definition, economic benefits and costs are inclusive of all social, environmental and economic factors, not just those affecting business. The problem is that many of these impacts are difficult, if not impossible, to accurately estimate in either quantities and/or values. This is especially true on the benefits-side.

Describing the benefits of environmental protection laws and regulations can be somewhat arbitrary. The common perception is that regulatory controls mitigate the impact of human activity on the environment ("social costs") resulting in cost-savings from improved human health and well-being, an improved legacy of natural resources handed down from generation to generation, and retention of aesthetic beauty. However, the cost of compliance to one set of firms is a benefit to other firms not held responsible for internalizing the social costs of environmental damage (e.g., firms not subject to FPA). The problem is that it is difficult to quantify and/or value many of these impacts since effective markets do not exist for them. As such, the requirement for federal and state agencies to conduct cost-benefit analysis of environmental regulations like the FPA tends to devolve to a more limited analysis of cost-effectiveness.

The costs of environmental regulations can be categorized in several ways. The most commonly perceived effect of environmental regulations is an increase industry's operational costs. Additional effects can be incurred at industrial/market levels such as increased transactions costs and uncertainty over meeting regulatory requirements and gaining final approval. Reduction in the capitalized value of timberland can arise from increased risk and uncertainty due to rapidly changing environmental regulations.

Despite the intended net benefits of government interventions in the marketplace, serious economic costs and social disruptions have resulted from increasingly burdensome and uncertain environmental regulations. Many scientists and policymakers assert that these policies simply export our environmental problems as we protect our ecosystems since our food and fiber consumption continues unabated (Laaksonen-Craig, et al. 2003). Domestically, the most direct effects from

regulatory burdens include shifts in forest product production and jobs out of state and country, reduction of incomes and state revenues, disruption of community stability, and diminished capacity to implement policy on federal lands within California. Less obvious effects include (1) shifts in land use away from rural/wildland to more intensive uses such as housing development, (2) reduced forest health and increased fire risk, and finally (3) reduced industrial capacity needed in efforts to improve health of public forests.

As discussed above, studies on the effects of environmental regulations tend to dwell on the regulatory effect on operating and management costs. This is also true of this phase of our long-term study of the effect of environmental regulations on California's forest products industry. To understand the cost effects of California's Forest Practices Act, one needs to understand how its purpose, implementation structure and scope have evolved since its inception in 1973.

CALIFORNIA'S FOREST PRACTICES ACT

The dominant forces behind U.S. environmental law and regulations are federal legislation, court rulings, and executive branch actions in response to political pressure. Nevertheless, states possess considerable latitude and discretion in their efforts to obey federal law while meeting the demands of its citizens for healthy economies and environments. Cursory observation shows that regulation of forest practices varies considerably by state. On one end of the spectrum, many states use voluntary laws that promote best management practices. At the other extreme, a number of states rely upon comprehensive acts characterized by mandatory, process-oriented regulations. States with comprehensive FPAs include Oregon, Washington, Alaska and, of course, California. Those using a voluntary or outcome-based approach comprise primarily the Southern states.

California has generally led the United States in measures to protect environmental quality; this is particularly so for forests. California's Board of Forestry, established in 1885, was one of the nation's earliest governmental bodies formed to protect its private forestlands. Today, the California Board of Forestry and Fire Protection is responsible for administering the FPA and promulgating the Act's rules and regulations. The California Department of Forestry and Fire Protection (CDF) is responsible for code enforcement.

1973 Forest Practices Act

In 1945, California passed its first forest practices act; however, it was found to be unconstitutional in 1970 on the grounds that the industry was essentially self-regulated (*Bayside Timber v. San Mateo*

Co., Superior Court, No 148093). The remedy required new legislation and in September 1973 the Z'Berg-Nejedly Forest Practices Act (AB 227) was signed into law by Governor Reagan. The purpose of this law was to ensure "maximum sustained production of high quality wood products . . . while giving consideration to measures proposed to reduce or avoid significant adverse impacts . . . on the land . . ." (Title 14, Chp. 4, Sub 2, Article 1, Part 897).

A year earlier, California enacted the Professional Foresters Law mandating that only licensed professional foresters were allowed to manipulate forest vegetation on state and private lands. Additionally, the law mandated procedures to license professional foresters (Registered Professional Foresters, RPFs). As with all state licensure, civil and criminal penalties are available for failure to adhere to the licensure standards and requirements. The critical nexus with this law and the 1973 law was that only a Registered Professional Forester is permitted to submit a Timber Harvest Plan.

Enactment of the 1973 FPA did not include any emergency provisions and therefore interim logging rules applied until a newly appointed Board of Forestry could promulgate new regulations (Arvola 1976). In November 1974, the new FPA rules became effective. In the intervening year, 2500 harvest plans were filed with the CDF (Arvola 1976).

The new FPA had barely been in force when new litigation imposed another major overhaul of the law. The Natural Resources Defense Council (NRDC), a non-governmental organization staffed primarily by lawyers, filed suit against three timber companies operating in the basin surrounding the newly formed Redwood National Park in Humboldt County, claiming that timber operations represented a "project" under the CEQA which was passed the same year (*NRDC v. Arcata Redwood Co., Humboldt Co. Court, No. 54212*). In January 1975, the court ruled in the NRDC's favor, forcing emergency action by Governor Brown to bring the FPA into conformity with CEQA.

Confusion reigned for nearly 6 months until new forest practice rules and THP regulations took effect. It now seems appropriate to assign 1976 as the year when this revised Timber Harvest Plan formed the basis for the current provision. All subsequent policy changes essentially represent amendments to the 1976 status.

After 1976, the THP became the functional equivalent to an Environmental Impact Report (EIR) under the CEQA, continuing to incorporate all relevant federal environmental law. Some of the key features added to the THP centered on the CEQA's public disclosure requirements such as feasibility analysis, public review, and appeals procedures. Analysis of cumulative effects from logging was another requirement imposed by CEQA. The requirement to provide public notice of a THP was

added in 1979 in response to a state Supreme Court ruling in *Horn v. County of Ventura*. Table A.1 in Appendix A attempts to summarize these and other significant changes. Appendix B.2 presents the timeline for THP approval – a minimum of 60 days.

Turmoil in Early 1990s

Legal and regulatory actions seemed to remain fairly steady until the early 1990s when an array of environmental issues arose primarily from problems unique to California but with some impetus from federal legal and regulatory actions. A number of voter initiatives were proposed to dramatically alter forest practices on California's private forestlands but none passed. Nevertheless, the political momentum culminating in the Sierra Accord in 1991 (and the related Grand Accord in 1992) combined with court rulings forced the California Board of Forestry to issue a litany of emergency rules. Adopted almost *en masse* the following year (1993), these rules required the RPF to analyze and propose protection measures for old growth, watershed cumulative impacts, domestic water sources, sustained yield, as well as a variety of administrative procedures (Delfino 2004). More details on these and other regulatory actions are provided in Appendix A.

Perhaps the most significant among these new regulations resulted from the listing of the Northern Spotted Owl as "threatened" under the federal Endangered Species Act (ESA) in 1989. Though most of the impact of this listing was directed at the management of federal lands in California, the "take"[1] provisions under ESA caused major changes to THP preparation and logging practices on private lands. Contemporaneous with protection regulations for the Northern Spotted Owl (and other sub-species) was a host of other species that were declared "threatened" under both ESA and California's ESA (CCR 895.1 and 959.10). The Coast District (essentially the coastal counties above the San Francisco Bay Area, a.k.a. the redwood region) was especially hard hit by these new regulations. Not only is this region part of the range of the NSO but also the newly listed Marbled Murrelet that biologists assert need large, old trees for nesting habitat.

Watershed protection was also central to the significant changes and expansion of regulations in the early 1990s. One highly significant change was the loss of the general waiver for non-point source pollution from silvicultural operations (Section 208 of the Clean Water Act) in 1993. Afterward, each THP had to include an individualized stream monitoring plan to address concerns over non-point sources of pollution during harvesting operations. As permanent roads and bridges were

[1] In contrast to the 5th Amendment Take Clause, the U.S. Fish & Wildlife Service defines a "take" of a threatened or endangered species, listed under the Endangered Species Act, as any action that could "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Habitat alteration especially related to timber harvest activity was added by the U.S. Supreme Court in *Sweet Home Communities vs. U.S. Dept. of Interior*.

considered a major source of stream sedimentation, a new array of rules for post-harvest road maintenance took effect.

This relatively sudden addition of numerous amendments and expanded review from multiple agencies transformed the original CEQA process into a complex, time-consuming ordeal that rivals some of the most complex EIRs (see the brief summary of the 1993 rule changes in Appendix A). The burden of regulatory enforcement shifted from the CDF to the Registered Professional Forester as a result of FPA rule changes finalized in 1991 (Delfino 2004). In the short-run, timberland owners pay for the cost of this added burden, not the timber purchaser. In the long-run, the increased cost to landowners in selling their timber would force some to switch to other land uses thus reducing supply and raising timber prices.

Table 1 summarizes the typical activities associated with preparing a THP for final approval, distinguishing between those included under normal contractual arrangements from activities that take place when the THP encounters opposition. See Appendix B.1 and B.2 for the current THP checklist, and THP filing and approval timeline, respectively.

Table 1. Activities involved in preparing a THP for approval

Standard Activities required	Activities not included under normal conditions
CEQA Feasibility Analysis (e.g., economics of sale, watercourse, wildlife, timber markets and community/neighbor conditions)	If not already done, need to prepare a long-term management plan to ensure sustained yield of high quality wood products for "large" properties. Requires costly inventories.
Evaluation of timber quantity and quality for sale	
Decision analysis on choice of silvicultural system	
Watercourse evaluation and surveying sale boundaries; estimation of erosion hazard rating	If sale is within a "Threatened & Impaired" watershed, a survey and mapping of watercourses and detailed analysis is required.
Marking timber for harvest generally required if only to identify WLPZ, wildlife or other "leave" trees.	
Location of logging roads, landings, and yarding routes; new road construction.	Older, formerly legal roads now require relocation to reduce impacts on WLPZ or other sensitive areas; development of a road mgmt. plan.
Watercourse monitoring plan prepared	New Water Quality General Waste Discharge requirements complicate this process especially when combined with CDF review and DF&G 1600 process. DF&G will not complete processing 1600 Agreement until THP is approved.
Evaluation of cultural resources and archeological survey; Records-check fees. Preparation of plan addendum	

Survey for wildlife species of concern under the Endangered Species Act	Additional wildlife surveys if a "listed" species is present or critical habitat is involved. NSO surveys generally require start around Feb 1 for 1-2 weeks or more after May 15 or June 1 of year to obtain letter from USF&WS. Plant/ botanical surveys may require start in early spring and going late into summer to survey during flowering periods. DF&G uses CNPS lists as basis to require surveys. Goshawk, marbled murrelet, golden and bald eagle, raptor surveys, red tree vole surveys, etc.
Evaluation of potential insect or disease problems	
Evaluation of potential cumulative impacts	
Filing of Notice of Intent, THP document preparation and interaction with CDF	
Pre-harvest inspections (PHI) involving CDF forester and numerous other state and local agencies	Significant delays due to conflicts between state agencies over plan requirements and multiple PHIs.
Public Hearings & related work leading to final approval	Additional testimony and work when PHI results in plan modification
Oversight of logging (depending on contract with landowner)	Oversight of logging operations
Oversight of road work for compliance with water quality laws upon completion of logging operations	Delays in obtaining inspection reports from RWQCB staff.
Oversight of site preparation for regeneration	
Inventory to ensure adequate tree regeneration is achieved within 2 years from end of logging	Litigation costs if THP is appealed

Note: An approved THP remains active for 3 years with the opportunity to extend it an additional 2 years if approved by CDF.

For almost two decades the only agency to which private landowners and their consulting forester had been required to respond was the CDF. Occasionally, other state agency officials would become involved if the environmental impact concerns were deemed significant. Usually though, only the CDF forester and the proposing RPF were present at the pre-harvest inspections (PHI). The PHI was a critical step in the approval of a THP when two experts, one representing the landowner and the other the state (CDF), would confer on-site to reach consensus with environmental protection the dominant theme.

Today, the number of state and federal agencies that are involved in approving a THP are manifold. At one recent two-day PHI on a THP at the Valencia Unit of Swanton Pacific Ranch, 10 individuals were present representing the following agencies: CDF (2), Cal Fish & Game, Regional Water Quality Control Board, California Geological Survey, County Planning, State Archeologist, and a Santa Cruz Co. Supervisor with an assistant. Swanton Pacific is a 3600 acre property under the management of Cal Poly, San Luis Obispo, for demonstrating quality forest management. This management was internationally recognized by the Forest Stewardship Council (FSC) in 2004 (see

Dicus and Delfino 2003 on the comparison between California's FPA and FSC certification standards).

Recent legislation transferred final regulatory authority over the THP approval process from CDF to the Regional Water Quality Control Boards (SB 810, signed into law 10/12/03 and recently perfected under administrative law review). The purpose of this legislation appears to be a response to the dominance of water quality issues in land management over the last decade. The effect of this recent addition to regulatory oversight remains uncertain, but it certainly does not simply or shorten the approval process.

CHANGES IN CALIFORNIA'S WOOD PRODUCTS INDUSTRY

This section of the report provides background economic information on the forest products industry. Lawmakers need this information in order to properly evaluate any policy action that could be considered as inhibiting California's competitiveness. Softwood lumber products have been and remain the mainstay of California's forest products industry[2]. To understand the effects of the FPA, it is useful to characterize the state's economic status and trend relative to the U.S. and regional forest products industry. The single best measure that captures the economic condition of the wood market is the price of lumber products as measured by the Lumber and Wood Products Producer Price Index (PPI) Composite (Bureau of Labor Statistics 2004), shown in Figure 1 below.

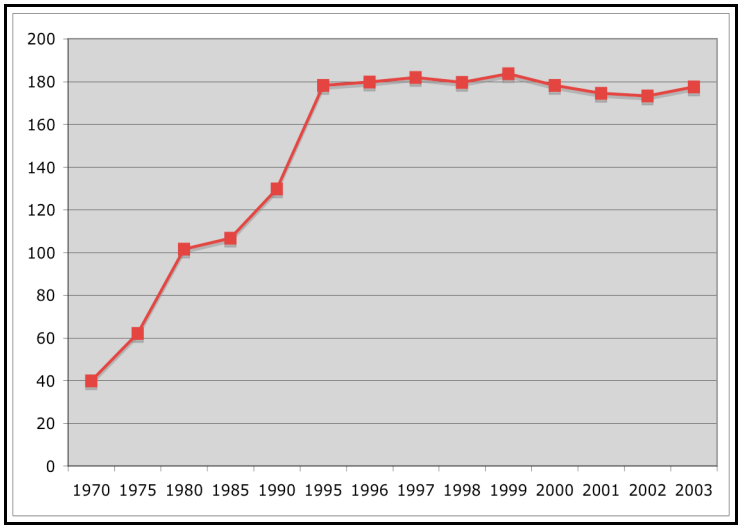

Figure 1. Producer Price Index (constant dollars, 1980 = 100) for lumber and wood products, 1973 – 2003.

[2] Lumber is perhaps the most common example of the class of products termed solidwood products in contrast to paper products. Other solidwood products may include panel products such as plywood, waferboard, and OSB. Softwood generally refers to a class of coniferous species such as pine and fir.

Clearly, lumber prices escalated rapidly during the 1970s and 80s then abruptly "flattened" to a constant rate in the early 1990s. Economic forces that created this structural change are manifold but the effect is simple – firms with lower production costs will be able to survive longer. Any policy action that is applied asymmetrically among states could cause those firms negatively affected to lose competitive position.

The time period when U.S. lumber prices stopped their historic escalation corresponds almost exactly with to era in California when forest practices regulations were greatly intensified, described in the previous section of this report. To understand the condition of California's forest products industry it is important to contrast it with their nearest economic rival -- Oregon, the dominant wood producing state in the Western U.S.

California Softwood Lumber Production

California's wood products industry is becoming increasingly concentrated -- fewer small, local firms being replaced by larger, more efficient mills designed for smaller logs. This trend is seen in comparing the industry data over the last 30 years in Figures 2a-d. Amid a significant decline in Western softwood production, California's share of that lumber market declined from 25% to 15% on a volume-basis (Figure 2d), Oregon's share remained relatively stable at around 37%.

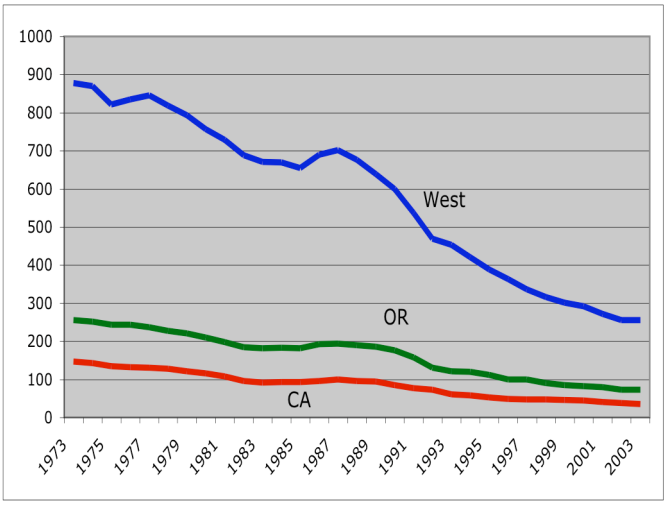

Figure 2a. Operating sawmills, 1973 - 2003

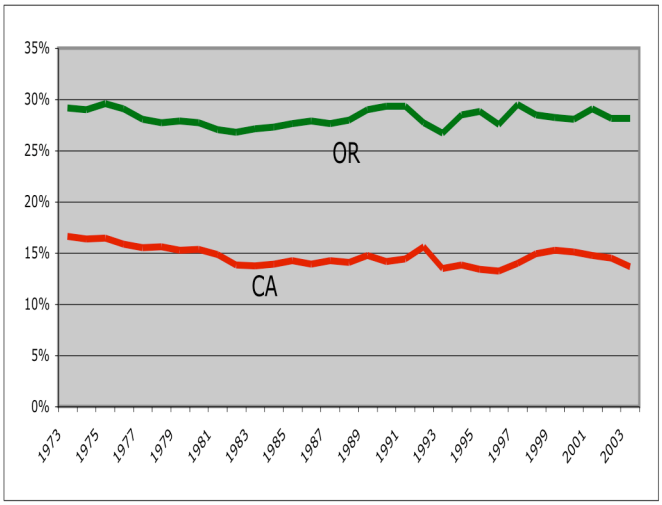

Figure 2b. Percent of Western mills, 1973-2003

Since 1973, the average California softwood lumber mill's production increased from 37 to 76 million board feet (mmbf) per year (WWPA 2004). Since 1988, 49 lumber mills closed in California, drastically reducing processing capacity from 6 billion board feet bf per year to 2.4 billion bf per year (Morgan, et al. 2004). As economic theory suggests, these losses were comprised principally of

smaller mill closures, mills that are less efficient and originally designed for larger logs that are generally no longer available. Solidwood processing facilities increasingly comprise the dominant share of the wood products industry in the Pacific Northwest and more so in California (see Figures 2c and 2d).

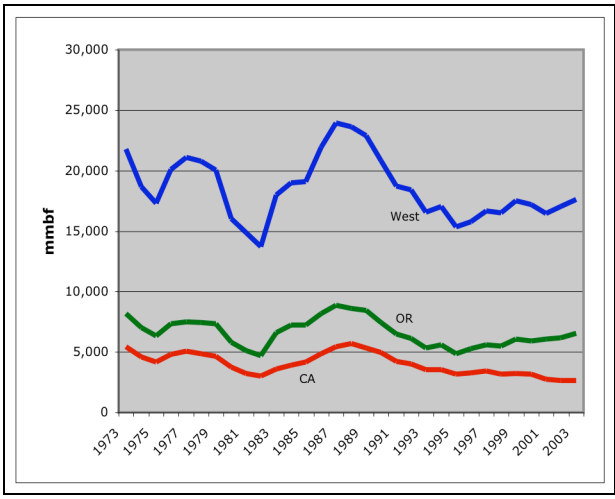

Figure 2c. Softwood production, 1973 – 2003

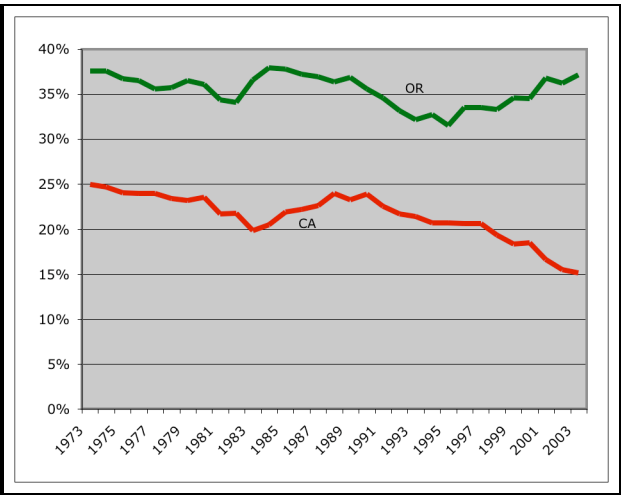

Figure 2d. Percent of Western production, 1973-2003

Pulp, Paper and Panel Production

The Pacific Northwest does not have a major share of the paper and related composite materials market, a result of a variety of factors -- biological, physical, social/political, economic. Any state, like California, containing significant public forestland is constrained by federal statutes that began in the mid-1970s laws that essentially favor growing large trees that possess higher value for solidwood products.

Pulp and paper production requires regular, high-volume flows of wood biomass. This in turn creates economic incentives to shorten timber rotation periods. California's, and most of the West's, biological and socio-political environment is not favorable for the type of land management practices needed to support a pulp and paper industry. Furthermore, paper production requires large quantities of water and produce effluent that can threaten water quality – both serious issues in California. As a result, pulp and paperboard production declined from 17 facilities in 1968 to 7 in 2000 (Morgan, et al. 2004). California's plywood and veneer production facilities declined from 26 in 1968 to only two in 2000. However, the South, with its much smaller proportion of forestland held publicly, and more stable water supplies, is not so constrained. Therefore, it is not unexpected that market share on a volume-basis has migrated significantly to the South. This worsens the timber

capital investment environment in the West and increases the likelihood of land conversion to other uses, many of which have greater environmentally degrading impacts.

Timber Harvests

As with most natural resource based industries, wholesale wood product markets are increasingly international in structure. The U.S. has been a net importer of wood products for much of the later 20th century. California was a key player in this process. Until around the mid-1970s, California was a net exporter of wood products. Since then, California's population boom has fueled a rapid increase in wood consumption. Laaksonen-Craig, et al. (2003) estimate that California's lumber consumption alone grew by 1 billion bf during the 1990s. Other wood product consumption grew even faster, e.g., wood panel products. At the same time the state's total harvests declined to a little over 2 mmmbf by 2000 (see Figure 3 from Morgan, et al. 2004).

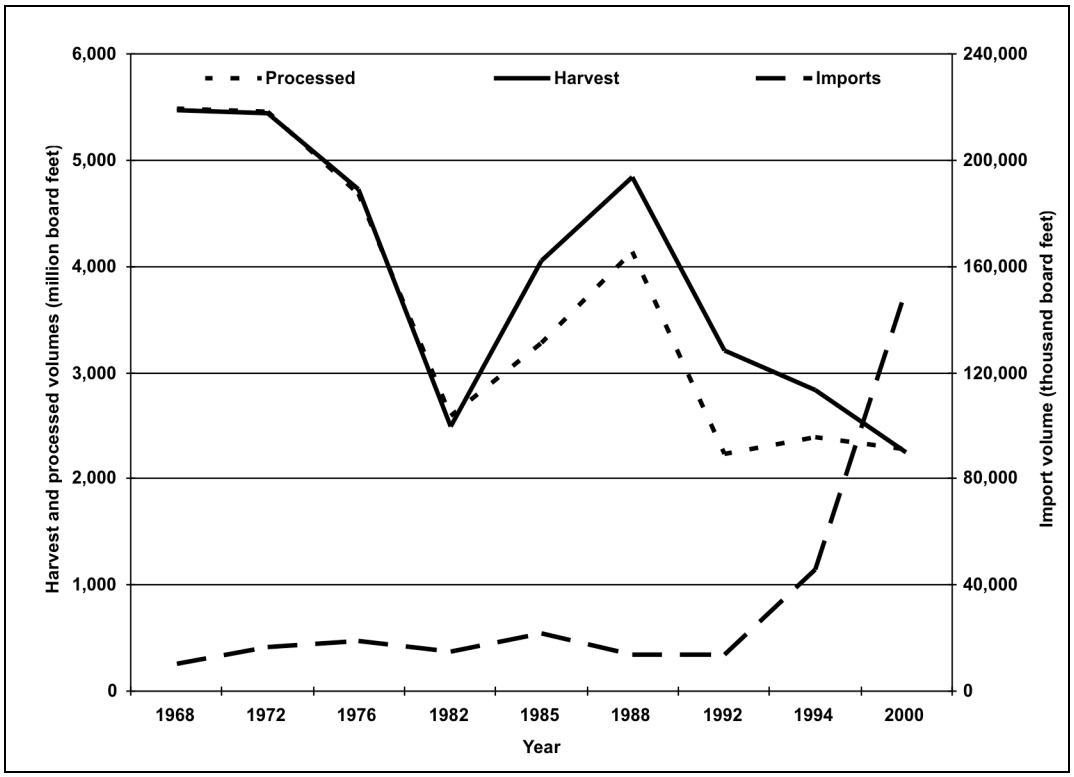

Figure 3. Volume of California timber harvested, processed and imported.

Declining timber harvests in California are not distributed equally across ownership classes. As changing economic conditions induce declining harvest volumes, firms and forestland owners alter their decisions accordingly. The result is that fewer small timber sales are offered as predicted by the

principle of economies of size -- the fixed costs of timber sale preparation represent a significant proportion of per unit costs thereby reducing profitability. Figures 4a and 4b reinforce this fact.

As a result of a more uncertain and lower return future forestland owners are less likely to invest in land uses. Thus, owners of small timberland holdings should be expected to redirect their land management objectives toward alternative uses with higher returns. This phenomenon is supported by the information illustrated in Figures 4a and 4c where average timber sale size begins to increase again about the time when the dramatic changes in the FPA of the early 1990s began to be enforced (Hall 2004).

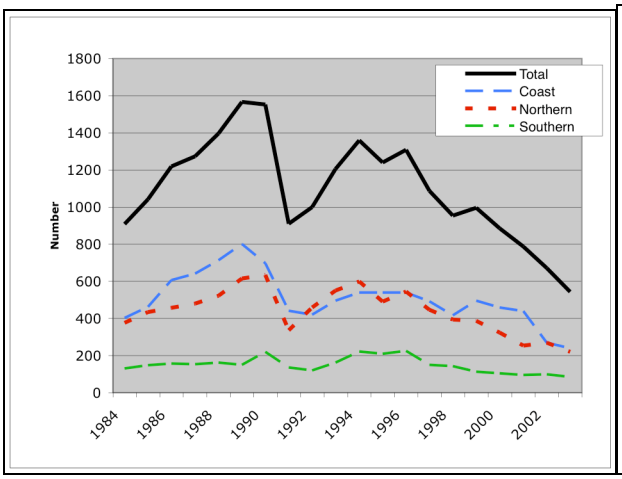

Figure 4a. THPs by CDF District, 1984-2003

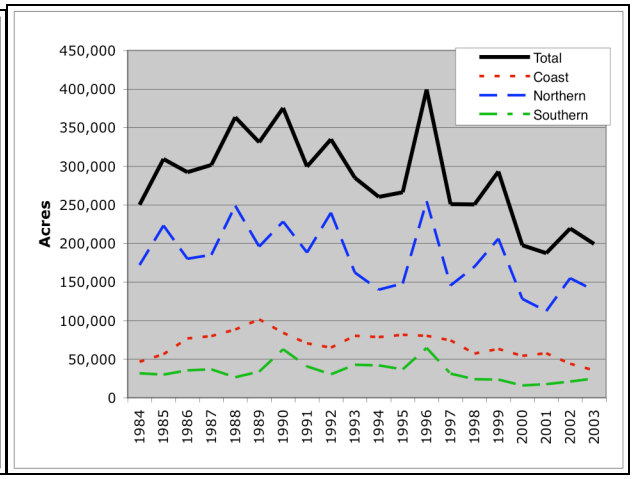

Figure 4b. Total THP acres by CDF District, 1984-2003

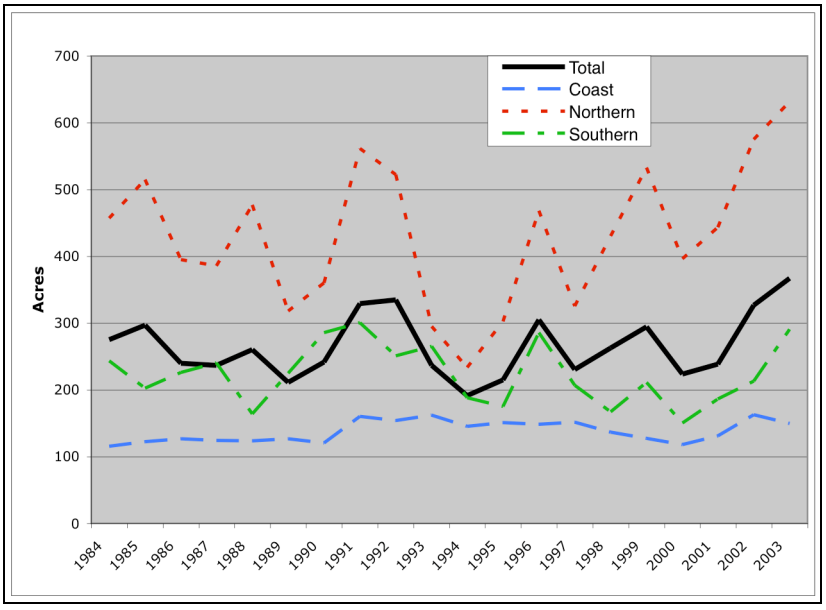

Figure 4c. Average THP size by CDF District, 1984-2003

The greatest increase in average sale size took place in the Northern District where volumes per acre tend to be lower than in the Coast District creating an incentive to expand THP size (see Figure 4c). In the Coast District, where regulatory pressures are the greatest, average sale size also increased but not as fast, perhaps since potential environmental impacts tend to increase with sale area.

Structural Causes of Trends

Causes for these structural changes involve a complex array of economic, social and political conditions. The post-war building boom combined with somewhat unrestrained logging practices created high timber harvest rates on private land that were probably not sustainable. Federal policy supported this boom by increasing the harvest levels on the public lands (see Figure 5). More recently, the highly publicized imports of cheaper Canadian lumber and technological advances in building materials are also forces behind California's shift to becoming a net wood importer.

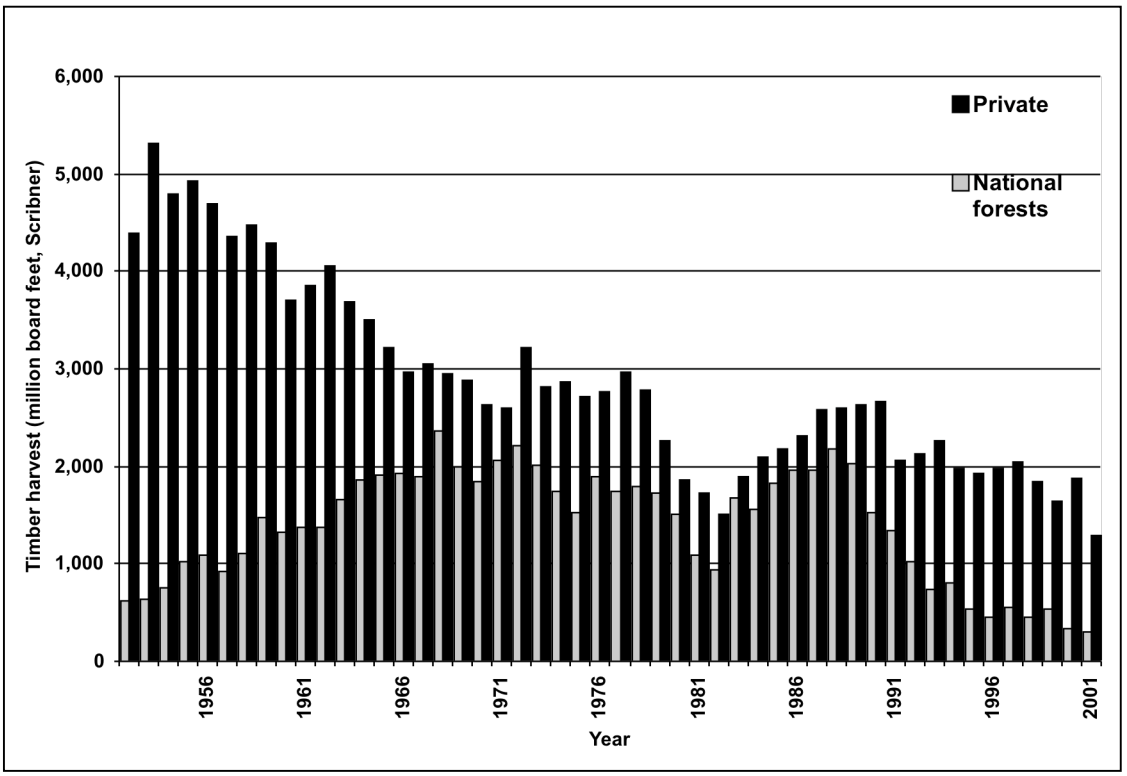

Figure 5. California timber harvest volume by landowner class, 1947 -2001

Somewhat reflective of the changing socio-political climate, California's policies have de-emphasized resource utilization in favor of amenity values requiring greater environmental protection. This trend is most noticeable in its forest resource management policies, i.e., the California Forest Practices Act.

In the study by Morgan, et al. (2004), 32 mill managers, land managers, and other key executives were surveyed on issues important to California's forest product industry. Their results revealed that forest practices and related environmental regulations were the most important issue affecting the industry's competitiveness (see Table 2 below).

Table 2. Issues important to California's forest industry leaders, last 10 years

Rank	Importance of issues over the last 10 years	Very un-important	Mostly un-important	Slightly un-important	Neutral	Slightly Important	Mostly important	Very important
		Percent						
1	California regulations	3	--	9	--	--	6	81
2	Market Conditions	3	--	6	6	13	22	50
3	Timber availability	13	6	3	--	3	9	66
4	Federal regulations	3	6	3	16	16	25	31
5	Harvesting/milling technology	3	6	9	19	31	19	13
6	Skilled labor availability	9	--	16	22	25	12	16

Source: Morgan, et al. 2004.

The public perception is that regulations and other cost-increasing effects on firms are simply passed along to consumers. However, theory and observation demonstrate that consumers in any country, or region within a country, purchase based upon price almost exclusively (Hartsfield and Ostermeier 2003, Kilgore and Blinn 2003). Wood product markets, like those for agricultural products, are international in scope. As such, efforts by any single nation or "state" within a nation to increase environmental protection may not be paid for directly by consumers but will be born by exporting nations that generally lack such protections. The key word is "directly" since the costs will be felt ultimately but not necessarily by the targeted firms or with the desired environmental effect.

Considerable resources have been expended in order to establish international standards for sustainable forest resource management (e.g., Forest Stewardship Council certification, an international organization backed by numerous environmental interest groups). Those paying for this credential presumably anticipated that domestic consumers would be willing to pay for these standards through more expensive products. However, research has not been supportive of this notion. Consumers have not overwhelmingly expressed a willingness to pay for such green products, forcing companies to either pass these costs on to timberland owners or absorb them in the short-run

due to competition from non-certified companies (Hartsfield and Ostermeier 2003, Kilgore and Blinn 2003).

Figure 6 illustrates how the economic return to private timberland owners and to the public's lands reflected symmetry in societal expectations of resource stewardship until the mid 1990s (California Board of Equilization 2004). Declining public values are easily explained by the significant reduction in volume and size of timber sold resulting from the listing of the Northern Spotted Owl as endangered (Flora and McGinnis 1992). Private timberland owner rents have declined since 1993 with only one "up year" in 2001 despite a fairly steady wholesale market value for lumber and wood products. This change corresponds almost perfectly, including the predictable lagged effect, with the significant expansion in the scope and intensity of forest practice regulation between 1991 and 1993.

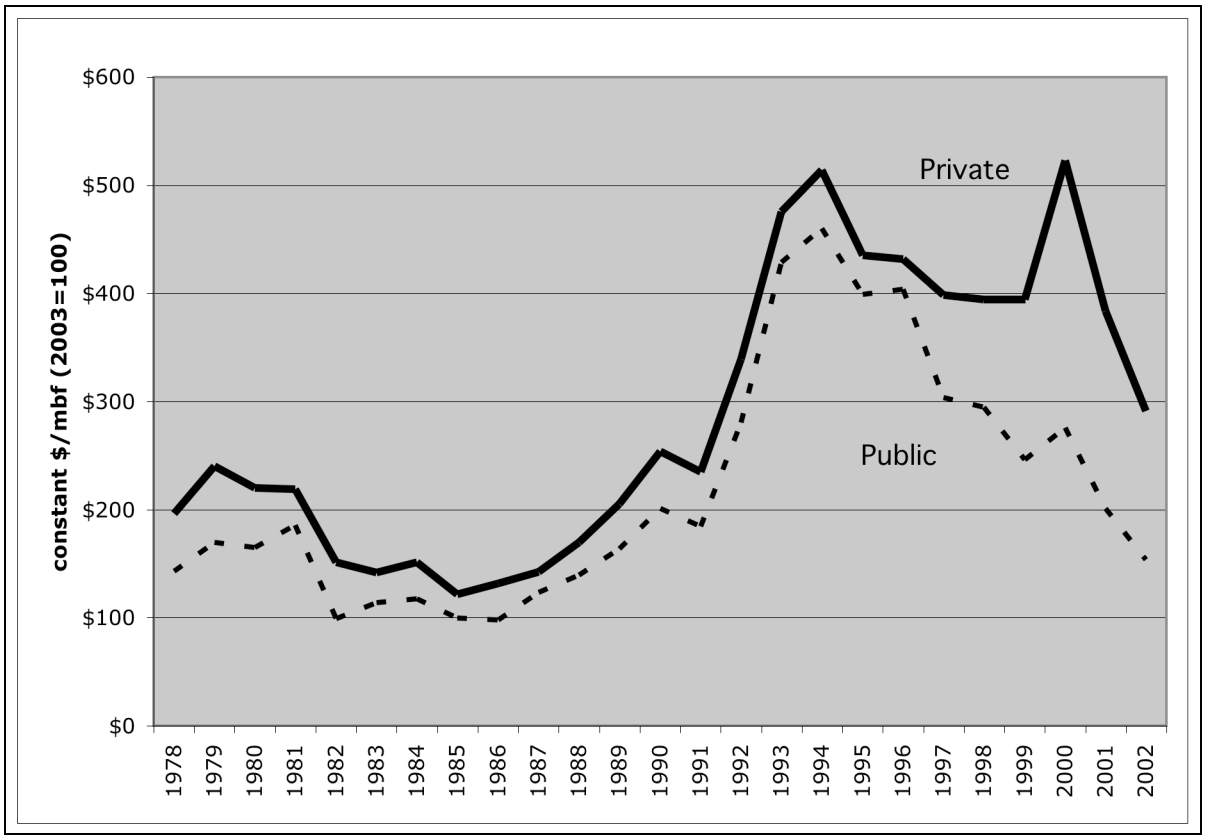

Figure 6. Returns to timberland owners (rents) for retaining land use in timber, 1978-2002.

Declining returns to private investment coupled with mounting regulatory hurdles create incentives to convert to other land uses. In turn, small landholdings become economically infeasible inducing an increasing number of forest landowners to harvest sooner than otherwise planned due to future uncertainties over regulatory requirements (Johnson, et al. 1997).

TRENDS IN TIMBER HARVEST PLAN COSTS

Given the short timeline of this project, one realistic goal was to summarize the existing scientific (peer-reviewed) literature on the status, trend and economic impact of California's ever-changing forest practice laws and regulations. Nevertheless, we set as our primary goal to estimate the upward trend in the cost of preparing THPs. This decision is due in large part to the growing concern over costs on the part of those preparing THPs over the costs. Until recently, interest in the subject was limited. Recent political events, such as the California Governor Schwarzenegger's attempt to reorganize state agencies and their regulatory functions, have raised the importance of this issue. To estimate the trend in THP preparation costs (the key transaction cost in California's timber market) requires collection of primary data – a problematic undertaking for this short-term project.

As early as the late 1970s, the costs of complying with the new FPA law were estimated to average about $20 per thousand board feet (mbf) of timber sold at a time when stumpage prices averaged less than $100 per mbf – roughly a 20% increase in production costs (Green, et al. 1981, Vaux 1984). Since then, environmental regulations have grown in breadth and intensity, imposing higher costs at a time when international competition grew substantially, epitomized by the widely publicized increase in, and continued trade policy conflict over, Canadian imported wood products. Thus, costs of the present regulatory burden may be exacting an even greater toll on competitiveness.

There have been few independent studies on the cost of environmental regulations to California's forest products industry. Perhaps the first comprehensive review and analysis of California's Forest Practice regulations was by Green, et al. (1981) which summarized internal studies by the CDF and the judgment of experts. They estimated the average cost of preparing a THP at $750 in the late 1970s, or about $0.50 per mbf, or about $1900 and $1.25/mbf in today's dollars, respectively. Costs incurred by the state to administer and enforce the FPA averaged about $1,150 per plan, or about $1 per mbf, or about another $2.5/mbf in today's dollars.

As described earlier, the goal of this study was to determine the causes and effects of the growing cost of preparing a timber sale in California. Fundamental to this goal is the need to accurately estimate these costs since the inception of the FPA in 1973. However, the source of this information is held privately by two basic groups – wood processing firms and consultants. *The challenge is to obtain this proprietary information in scientifically valid manner while ensuring confidentiality and avoiding collusion concerns.*

METHODS

The first task in our methodology was to identify those who possess the needed information, i.e., the population for our survey. Industrial, wood-processing firms prepare THPs employing either staff foresters or subcontract to consulting RPFs. Private non-industrial forestland (NIPF) owners can hire consultant foresters or rely upon the staff foresters of the firm purchasing their timber. All these options complicated our sample methodology.

There are a number of conditions that inhibit or even prevent firms from responding to our survey. Quality of record-keeping varies across firms and especially over time. Beginning in the early 1990s, most consultants computerized their accounting records, but earlier paper records often were not archived. Some consultants dropped THP preparation services and therefore were withdrawn from the population. Furthermore, as described earlier in this report, the wood processing industry in California has experienced considerable consolidation since 1973. Although industrial firms have computerized their records since the 1970s, buyouts and mergers have resulted in lost records or changes in record-keeping practices.

Based on our initial contacts with these firms, 28 wood processing firms and 24 consultants were identified from which to request data on THP preparation costs (see Appendix C.1 for the final list of firms that comprise our population). These firms are not quite the entire population of RPFs currently preparing THPs but certainly represent the vast majority, especially on a harvest-volume basis.

The instrument used to collect the data was a survey form mailed (and emailed) to that population group in June 2004. Appendices C.2-1 and C.2-2 provide the survey instruments sent to wood-processing and consulting firms, respectively. Instructions for completing the survey are shown on the instrument forms. Typical random selection was not practical since the CDF's database of THPs includes only the name of the RPF who submitted the plan, not the firm for whom they worked. As such, it is problematic to connect the firm with the THP.

Each firm was given the opportunity to respond with a complete set of THPs for which records exist. In lieu of that, they were asked to submit a subset under the following conditions: the first 3 THPs approved per year for consultants, and the first 8 approved for processing firms. More were requested from processing firms because they generally submit a far greater number of THPs per year than do consultants. We decided to request a fixed number of THPs per year in time order of

approval, rather than the preferred, but unlikely, complete download of data. However, one consultant essentially provided a complete set of his approved THPs. This sample data collection method is effectively random given that there is no known relationship between THP cost and time order of approval with respect to the time order of submission.

As described in Appendix A, long-term plans were required of all industrial processors and NIPF landowners with holding greater than 5000 acres starting in 1993. The cost of preparing these long-term plans can influence subsequent THP preparation costs. Therefore, industrial processing firms and consultants were asked to indicate whether a given THP was associated with a Sustained Yield Plan (SYP) or Option A, or Non-industrial Timber Management Plan (NTMP), respectively[3]. The THP characteristics (data items) requested were limited to those that tended to have the greatest impact of THP preparation costs (see Table 3). The hypothesized functional form representing the empirical specification is given by

THP$ = f (YEAR, ACRES, N, S, MARKED, WLPZ, PLAN, YRDMMY)

See the Table 3 for definitions of each variable.

Table 3. Description of variables used in statistical analysis of THP costs, 1974 - 2004

Variable Name	Description
THP$	Total cost in preparing a THP including work to obtain final approval by CDF/BOF, adjusted to constant dollars using the Producer Price Index (PPI).
YEAR	Year of THP approval, serves as proxy for changing regulatory requirements
ACRES	Number of acres in THP
DISTRICT	CDF District: 1=Southern, 2=Northern, 3=Coast
N	1 = CDF Northern DISTRICT, 0 otherwise (Coast was the default)
S	1 = CDF Southern DISTRICT, 0 otherwise (Coast was the default)
MARKED	1 = timber was "marked" in THP preparation, 0 otherwise
WLPZ	1 = THP sale contained significant watercourse & lake protection zone issues, 0 otherwise
WILDLIFE	1 = THP sale contained significant wildlife protection concerns, 0 otherwise
PLAN	1 = THP was associated with a long-term management plan (SYP or NTMP), 0 otherwise
YRDMMY	1 if YEAR >= 1993, 0 otherwise

[3] Long-term mgmt. plans, as defined by CDF, include silvicultural activity planning (e.g., harvests, regeneration, pre-commercial thinning) 100 years into the future. NTMPs are needed for non-industrial, private timberland holdings over 5000 acres. SYPs and Option "A" pertain only to industrial wood-processors with timberland holdings.

RESULTS

Communications with each firm indicated a high degree of interest and desire to cooperate to the extent practical. Due to record-keeping practices, some were simply unable to respond.

Response to the survey was better than expected given the short data collection period, June - September 2004. Furthermore, this survey was conducted during the summer, the busiest time for timber harvesting. Five wood-processing, and 3 consulting firms responded, providing 607 sample THP sale observations (see Appendix D for a complete listing of sample THP observations). The most commonly cited by wood-processing firms for not responding was that their record-keeping systems did not separate-out internal staff time devoted to individual THPs. As for consultants, several had quit offering THP preparation services or their records were not archived.

Table 4 provides a summary of the useable THP data by firm class and CDF District. See Appendix C.1 and C.2 for listings of both groups of firms representing the sample population and their response. Average THP size was 378 acres, while the median THP size was only 73 acres (see Table C1-1 in Appendix C.1). This clearly indicates that there are a few very large THPs, while most tend to be less than 100 acres.

Table 4. Response by CDF District and type of firm

CDF District	Processing Firms	Consultants
Coast	303	137
Northern	105	42
Southern	20	0
Total	428	179

THP$** was deflated using the GDP Deflator (Bureau of Labor Statistics 2004). Deflation converts current dollars to constant dollars where 2003 was adopted as the base year index of 100 (Bureau of Labor Statistics, 2004). Averaging **THP$ in constant dollars each year provides an initial perspective on the trend in costs shown in Figure 7.

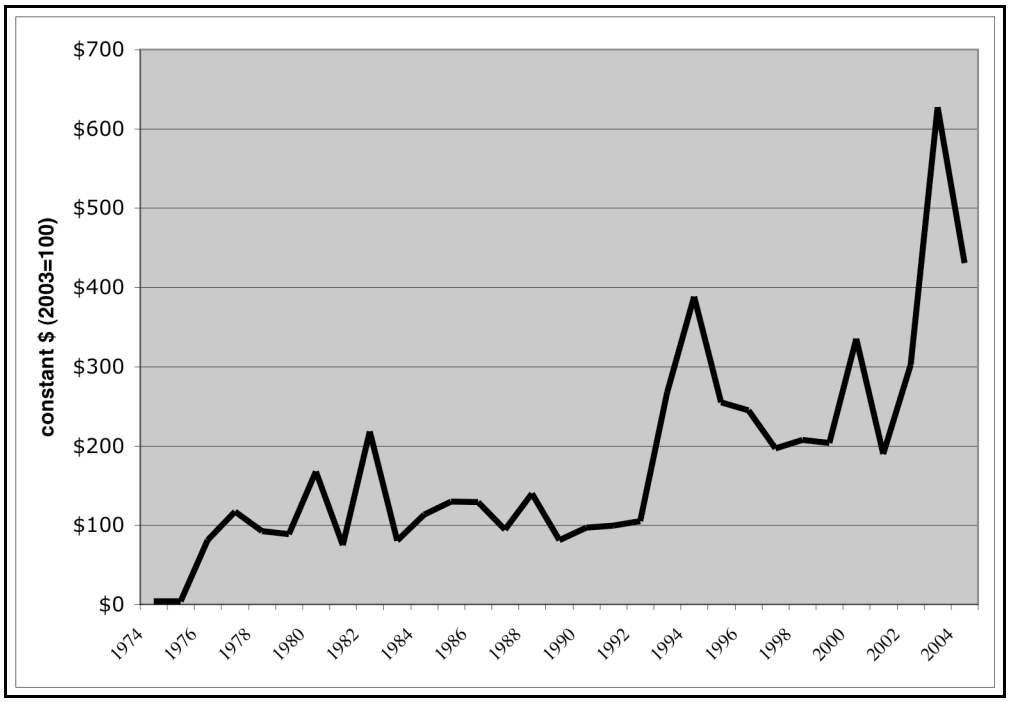

Figure 7. Average annual cost per acre of preparing a THP, 1974 – 2004.

The sample data reveal an obvious upward trend in THP costs especially beginning in the early 1990s. Prior to 1993, one could conclude from visual inspection that THP preparation costs were relatively constant over time. After then, there seems to be a clear correlation between the dramatic changes in environmental regulations and THP costs (see Table A.1, Appendix A). Certainly, further analysis is needed before a more definitive cause and effect relationship conclusion can be drawn between growing regulatory requirements and increasing THP costs.

Appendix C.3 presents descriptive statistical information on the variables, including graphical illustrations of the relationship between **THP$** and THP size by CDF District. The graphs in Appendix C.3 (Figures C3.1 to C3.3) indicate the relationship between timber sale area and the regulatory costs.

Ordinary least squares (OLS) regression was used to better understand sale characteristics that influence **THP$** in addition to sale area. To conduct OLS, variables must be defined that are (1) at least intervally-scaled, (2) independent of one another, and (3) somewhat normally distributed.

Predictive Model

Figure 7 illustrates clearly that the trend in THP costs has been increasing. The rate of increase does not seem to be linear. Exploratory OLS regression analysis indicated that model fit could be improved by using a semi-log model where **THP$** (in constant dollars), the dependent variable, was transformed using a natural logarithm. In addition, re-specification of **YRDMMY** was performed to ensure that the proper timing of the relatively sudden increase in **THP$** was accurately modeled. OLS regression results of the semi-log model are presented in Appendix C.4 (SPSS 2004 was used to perform all regression analyses). Sufficient independence among the predictor variables was confirmed by the low variance-inflation factors (VIF). Overall the OLS model accounted for over 70% of the variation in **THP$**.

The behavior of the error term (i.e., residual or unexplained variation in **THP$**) is a major concern in robust statistical procedures such as OLS regression. Two key assumptions of error term properties are that there is (1) no correlation among adjacent observations, a.k.a., autocorrelation, and (2) constant variance across time-related observations. These error terms properties are especially relevant to time-series data. The OLS regression only revealed a likely violation of autocorrelation requiring generalized least squares (GLS) by including only an autoregressive error term (see Appendix C.5 for elaboration on the statistical results). Results from application of this statistical technique are presented in Appendix C.5. All but two predictor variables were significant with confidence exceeding 99.9%; the Southern CDF District (**S**) was not significant, and **MARKED** was significant with just under 90% confidence.

Despite the well-established growth in the number and intensity of FPA environmental regulations over time (the proxy variable, **YEAR**), it is possible that other input or market-based changes are behind the exponentially increasing costs. Increasing wage rates is one explanation (Baumol 1993). Data obtained from responding firms indicated that wage rates declined in constant dollar terms, eliminating it as a possible explanation. Another related possibility is that there could have been an increase in competition among RPFs who provide THP preparation services. However, this is not logical since (1) most wood-processing firms prepared their THPs in-house, and (2) the RPF labor market remains competitive despite a slight decline in the number of consultants offering THP preparation services.

Another concern in estimating this model is the possibility that one or more firms were unrepresentative of the population and thus had an undue influence on the results (a type of non-response bias). Indicator variables were defined for each firm and GLS regressions were conducted. No firm indicator variables were statistically significant providing support for respondent representativeness.

One more common concern in such parametric procedures is that a few observations can have an undue influence on the model (a.k.a. influential data points or "outliers"). A check of the residuals from the OLS estimation reveals no such problem, but they do appear to indicate autocorrelation that was later corrected using autoregression (see the figure at end of Appendix C.4). Standardized residual analysis confirmed this conclusion.

As a result, the final prediction equation from the autoregressive semi-log model improved data fit, excluding only **S**, (see Appendix C.5 for elaboration). The final prediction specification is given by:

$$\begin{aligned} ln(\text{THP\$}) = {} & -68.736 + 0.0385(\text{YEAR}) + 0.00013(\text{ACRES}) - 0.527(\text{N}) + 0.087(\text{MARKED}) \\ & + 0.374(\text{WLPZ}) + 0.181(\text{WILDLIFE}) + 0.204(\text{PLAN}) + 0.424(\text{YRDMMY}) \\ & + 0.312(e_t - e_{t-1}) + e_t \, . \end{aligned}$$

The annual average predicted **THP$** values are illustrated in Figure 8. The model predicts that **average THP$ is nearly $30,000 today, up from around $2,200 in 1974 in constant dollars** – ***more than a 1200% increase in just 30 years***. That amounts to a compound annual rate of 8.5% above inflation. However much of this rate of increase was attributable to the significant cost "jump" around 1993.

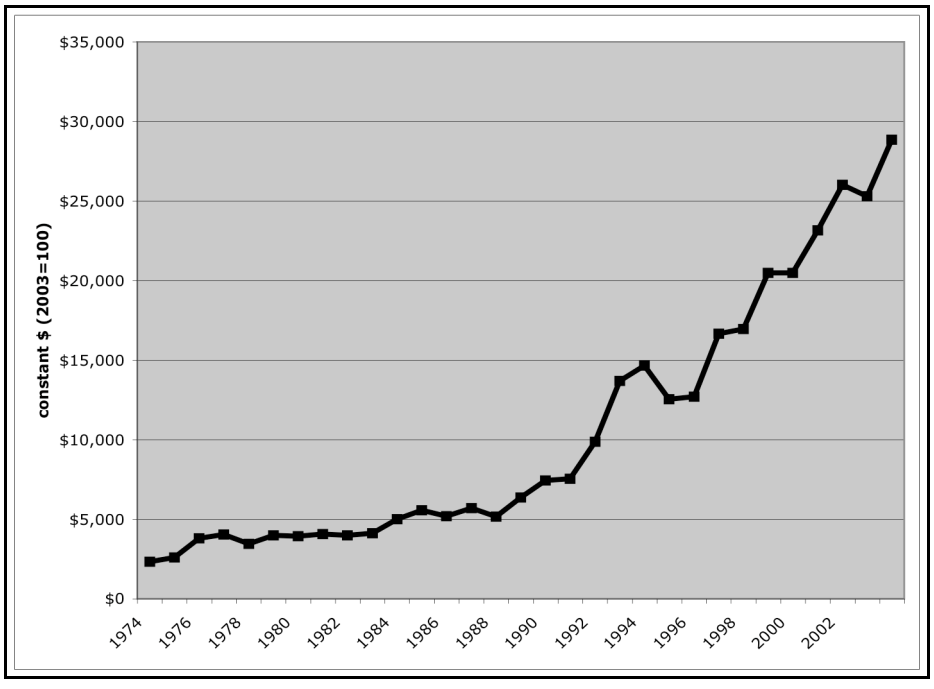

Figure 8. Predicted average annual THP costs over time from the autoregressive semi-log model

Perhaps a clearer way of communicating these results is to describe the predicted **THP$** of the "typical" timber sale. Limited by the sale characteristics sampled, a typical THP is one that was "unmarked", without significant WLPZ and wildlife concerns, and not associated with a long-term management plan (see Tables C3-1 and C3-2 in Appendix C.3). As Figure 4c illustrated, the average timber sale acreage differs significantly between the Coast, Northern, and Southern CDF Districts. The Coast District averaged 138 acres over 30 years, while the Northern averaged 431 acres. Again the distinction between Northern (**N**) and Southern (**S**) CDF Districts was insignificant in our model.

Since 1993, the typical THP has had significant Wildlife and WLPZ concerns and has been increasingly associated with a long-term management plan. Figure 9 displays the standardized predicted **THP$** for both the Coast and Northern CDF Districts for typical sale conditions post-1993 excluding the effect of being associated with a long-term plan. THPs have always been somewhat more costly in the Coast District owing to the more complex ecological conditions and amenity concerns of the redwood region.

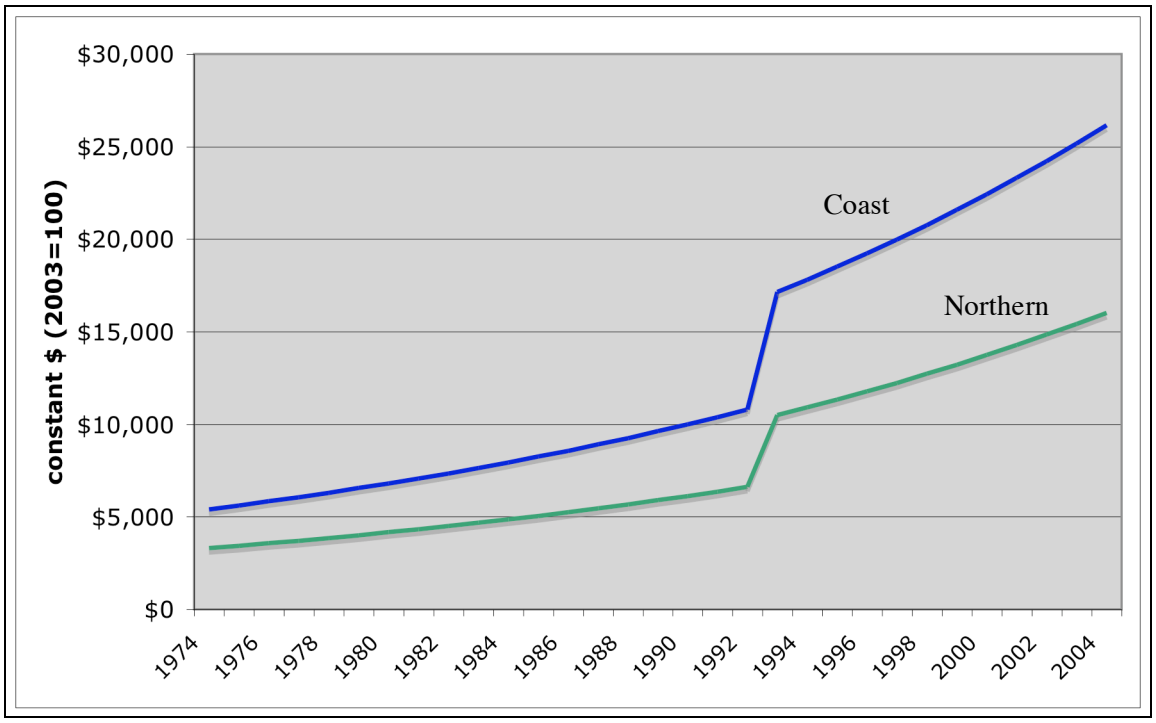

Figure 9. Standardized THP costs for the average post-1993 THP sale in the Coast (138 acres) and Northern (431 acres) CDF Districts, excluding a long-term plan.

Under these standardized assumptions, **THP$** increased at a compound annual rate of about 4% above inflation. The dramatic "jump" in **THP$** in 1993 detected in our model amounts to nearly 60% in just one year. The standardized cost to prepare a THP in the Coast District was $26,000 in 2004 but only

about $5,400 30 years ago in today's dollars. That represents a 5-fold increase in just 30 years in the Coast District and nearly as much in the Northern District (**N**).

One important reason why these standardized conditions result in a somewhat lower rate of **THP$** increase is the recent requirement to prepare a long-term for larger non-industrial and industrial properties starting in 1993. Without an approved long-term plan, no subsequent THP on those timberlands would be approved. Figure 10 shows that the impact on **THP$** from requiring a long-term plan nearly doubled the cost "jump" in 1993, resulting in a 6-fold increase over the 30 years.

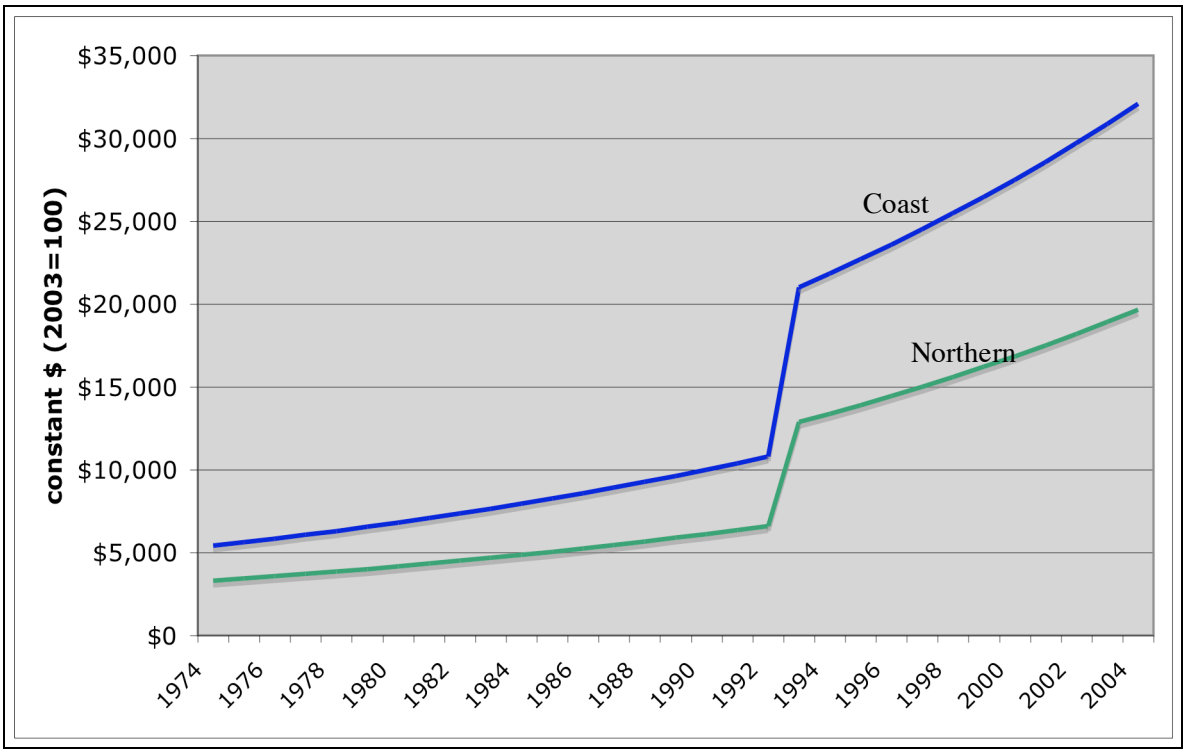

Figure 10. Standardized THP for the average post-1993 THP sale in the Coast (138 acres) and Northern (431 acres) CDF Districts with a long-term management plan

CONCLUSIONS AND FUTURE RESEARCH NEEDS

California's natural resources are increasingly under pressure to meet demands for both consumer goods and amenity uses. These conflicts create political pressure to protect environmental values in the process of extracting resources. Few resource-intensive industries have been more the focus of these political pressures than California's forest products industry. Other industries that are subject to intensive regulations include off shore oil production and more recently the fishing industry. Starting in the early 1970s, laws and regulations have expanded in breadth and intensity. The early 1990s was a time that saw great expansion and intensification of forest practice regulations.

Analysis of California's forest products industry indicates a growing dependence upon imported wood to meet its growing consumptive demands. Federal and state legislation has played a significant role in Californians' declining use of its public and private forests for wood production. There appears to be a correlation between these conditions. However, further study is required before direct cause and effect relationship can be drawn between California's increasing environmental regulations and declining wood production and market share. The recently approved "Healthy Forest Initiative" policy offers little, if any, regulatory relief, since it is directed solely at reducing forest density on our National Forests by thinning small and generally un-merchantible timber at taxpayer expense.

However, a clear cause and effect condition does exist between the level of growing environmental regulations in California and increased timber harvest planning costs. California's approach to protecting environmental values in preparing and conducting timber harvests is to impose a system of process-oriented regulations unlike other states that focus on environmental outcomes. In either case, planning is needed and appropriate for environmental protection. However, the process-oriented approach has the potential of "piling-on" work that produces little, if any, positive effect on the ground. With the cost of an individual THP now running over $30,000, it is likely that California's growing regulations have only created costlier sales, not "cleaner" ones. This cost does not reflect the significantly larger costs incurred if the THP encounters opposition. Nor does the average cost include the amount lost due to the mandated time minimums of the THP approval process. The time constraints keep the forestland owner from being able to time the sale for optimal market conditions. This review process has now been extended by the recent addition of final approval by the Regional Water Quality Control Board.

With economic rents (net revenues derived from markets up-channel) on small timber sales reaching only around $50,000, a THP that costs, at a minimum, $5,000 would discourage most from even considering

selling their timber. Furthermore, California's Forest Practices Act forces considerable alteration of logging operations, potentially increasing logging costs that reduce economic rents (i.e., "stumpage") to timberland owners. Thus, California timberland owners are "squeezed" on both the cost and revenue sides.

This study represents Phase II of a long-term study investigating the effects of California's environmental regulations on its economic and environmental health. Phase I compared the state's forest practice regulations to the international programs that certify sustainable resource management. This study helped sharpen the debate over the merits of the California's process-oriented forest practice regulations versus the outcome/goal-oriented approach to international certification programs.

Phase III, already underway, will investigate the regulatory impact on logging costs in the wood processing industry. The approach used in this phase involves comparing logging costs between California and other Western states, primarily Oregon, while controlling for sale conditions other than the differences in environmental regulations between these states. With better understanding of the effects of California's historic approach to protecting its environment while producing goods and services, we will be able to better judge the cost-effectiveness of its policies.

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Appendix A
Table 1. Summary of Key Events and Regulatory Actions affecting the FPA

Year	Description	Origin of Issue(s) Federal	State
1973	Passage of SB 183 - Z'Berg-Nejedly FPA resulting from court ruling that the 1945 "forest practices act" was unconstitutional.		X
1976	Revised FPA's THP to conform to CEQA in response to successful legal action by NRDC.		X
1981	SB 856 removed county level control over THPs which in turn resulted in special rule subdistricts administered by CDF		X
1982	Implementation of Erosion Hazard Rating System requiring an addendum to each THP. Adoption of Resource Conversation Standards for stocking requirement rule.	X	
1983	Implementation of Roads and Landing Rules. Implementation of Watercourse and Lake Protection Zone Rules.	X	
1988	Resulting from a 5 year multidisciplinary team review process of timber harvest operations in response to Section 208 (non-point source) of Clean Water Act, a range of new rules, documentation, and RPF/LTO training were adopted.	X	
1989	Implementation of new Erosion Control and Maintenance rules including a three year prescribed maintenance period after completion of harvesting. Adoption of new site preparation rules for protection of multiple resource values. Requires an addendum to THP. Formation of the first of numerous task forces dealing with cumulative impacts as a result of ruling in *EPIC v. Johnson, 1985*.	X	
1990	Implementation of new Erosion Hazard Rating system. Adopted emergency rules for Northern Spotted Owl habitat areas.	X	X
1991	Failure of voter initiatives (Sierra and Grand Accords) forced BOF to adopt numerous emergency rules most of which were adopted permanently. The major ones were as follows. Adoption of new Cumulative Impacts rules requiring additional THP material in Addendum #2; new in-stream monitoring plans and protocols per THP. Adoption of major new WLPZ and Roads & Landings rules to enact non-point source pollution (CWA Section 208) recommendations after expiration of general waiver for silvicultural practices. Additional rule amendments for Northern Spotted Owl habitat areas. Adoption of emergency rules for protection of Marbled Murrelet habitat. Adoption of rule amendments for archeological and historical sites. Further regulatory constraints on even-aged mgmt. (i.e. clearcutting). Requirement for industrial and large non-industrial owners to develop long-term mgmt. plans (SYP, Option A, NTMP). More information requirements in THP when late seral stage stands (sometimes called "old growth") are present.	X	
1992	Revision of Marbled Murrelet habitat protection rules	X	X
1993	Adoption of new THP rules for "sensitive" watersheds	X	

1994	"35 points of light" - rule and definition clarifications. Adoption of new Sensitive Watersheds & Domestic Water Supplies rules directing the BOF to classify a watershed as "sensitive" thereby requiring more intensive protection measures and greater documentation in relevant THPs. Adoption of new Silviculture for Sustained Yield rules resulting from failed voter initiatives to protect perceived forest values. Adoption of new rules for operations in late succesional stage stands.	X	X
1995	"23 points of light" - clarification of 23 rules/definitions left over from 1994.	X	
1997	Adoption of new Class III WLPZ rules to increase protection measures on ephemeral streams during harvesting operations.	X	
1999	Adoption of revised Cumulative Impacts Assessment rules impacting interpretation of Winter Period rules. Seven other rule amendments and definitions were adopted.	X	
2000	Adoption of major new protection measures for Threatened and Impaired Watersheds ("interim rules"), Coho Salmon Consideration rules, Plan Submitter, RPF and LTO Responsibilities rules resulting from CWA Section 303d actions.	X	
2001	Requires Certified Engineering Geologist to review timber operations in or near steep WLPZ areas. Requires complete water drafting plan be included in THP when drafting takes place. Increase WLPZ tree retention requirements and designation for "large, old trees"	X	
2002	Adoption of Interim Watershed Mitigation Addendum rule package proposed by landowners and resource managers by requiring additional watershed analysis, site-specific concerns and consideration of additional protection measures for watersheds containing listed anadromous salmonids. Designation of "Threatened and Impaired" watersheds.	X	X

Sources: Martin 1989, Yee 2004, Delfino 2004.

Appendix B
THP Process

Appendix B.1
CLFA Timber Harvest Plan Checklist, Revised 1998

The following table is provided to convey the primary and secondary categories comprising a typical THP (CLFA, 1998). The CLFA checklist is an 18 page document that can be downloaded from their website or CDF.

Section I. General THP Information

- Timberland owners
- Timber operator (LTO)
- RPF Submitting Plan
- Copy of Notice of Intent
- Legal Description
- Plan acreage
- Proposed commencement date
- Related to a long-term management plan (e.g., NTMP, SYP, or Option "a")

Section II. Silviculture

- Identify proposed silvicultural/regeneration system (even-aged, intermediate treatments, uneven-aged, special, alternative)
- Pests
- Harvesting Practices
- Winter Operations
- Roads and Landings
- WLPZ and Domestic Water Supply Protection Measures
- Hazard Reduction (logging slash management)
- Biological Resources (e.g., rare, threatened or endangered flora and fauna)
- Maps

Section III. Non-Operational Physical Conditions (soils, topography, vegetation and water)

Section IV. Cumulative Impact Assessment, Addendum #2

Section V. Attachments not required elsewhere in Plan

Section VI. Archaeological Addendum (confidential)

Appendix B.2

THP Approval Timeline & THP Components

THP Process

Purpose: to ensure max. sustained yields while protecting the environment; public disclosure per CEQA

Elements of Plan

1. Names, addresses, phone #'s of owners, RPF and Operator licenses
2. Neighbor notification
3. Operations area: legal description, district, stocking report, date of start, products to be harvested, skid trails
4. Indentify regeneration method, intermediate treatments, special harvest methods, etc.
5. Logging systems employed
6. Location and explanation of new permanent roads greater than 1 lane
7. Erosion controls
8. "while giving consideration" criteria
9. Arch. site survey and protection procedures, if needed
10. Insect and disease problems
11. T&E species inventory and protection procedures, if needed
12. Maps (logging area, skid trails, landings, streams, perm. roads, bridges, slides, understocked areas, etc.)

Minimum THP Timeline (days)

Feasibility Analysis conducted prior to filing as per CEQA

Notice of Intent

Review Team Mtg. (1)

Filing Date

Notice of Filing

Preharvest Inspection

Public Hearing (CEQA)

Response to sign. issues

Mitigation Measures by Rev. Team per CEQA

Director's Decision Date

Timbre Ops. begin

Appendix C
Survey Results & Statistical Analysis

Appendix C.1

List of Wood Processing Firms contacted for Data Collection

Wood Processing Firms	Response	Description
Bascom Pacific, LLC	No	No response
Brooks Walker	No	No response
Collins Pine Co.	Yes	102 THPs from 1974 to 2003; provided additional information on the THP process for Table 1
Crane Mills	No	No response
Fruit Growers Supply Co.	No	No response
Green Diamond Resource Co. (formerly Simpson Timber	Yes	224 THPs from 1976 to 2003
Gualala Redwoods	No	No response
Hancock Forest Mgmt.	No	No response
Hearst Corp.	No	Data not available
Lonestar Timber LLP	No	No response
Mendocino Redwood Co., LLC (formerly Louisiana Pacific)	Yes	24 THPs from 1999 to 2003
Pacific Lumber Co.	Yes	55 THPs from 1996 to 2003
PG&E	No	Unable to respond in time
Red River Forests Partnership	No	No response
Roseburg Forest Products	No	Unable to provide data in time
Sierra Forest Products	No	No response
Sierra Pacific Industries	No	Data not in form suitable for study
Siller Bros., Inc.	No	No response
Soper-Wheeler	No	THPs prepared by consultants
Southern California Edison	Yes	23 THPs from 1980 to 2003
The Campbell Group	No	No response
Timber Products Co.	No	No response
Trinity River Lumber Co.	No	No response

List of Forestry Consulting Firms contacted for Data Collection

Forestry Consulting Firms	Response	Description
AD&D Forestry Services	Yes	124 THPs from 1993 to 2004
Continental Resource Solutions, Inc.	No	Records not available
Darcie Mahoney	No	Data not available
Edward A. Tunheim	No	No response
Environmental Resource Solutions	No	No response
Forest Slopes Mgmt.	No	Records not available
Frank & Dean Solinsky Co.	No	No response
Gary F. Howard	No	No response
George Belden	Yes	12 THPs from 1999 to 2003
Hunt Surveying & Forestry Inc.	No	No response
J.E. Fleming & Assoc.	No	No response
Jacobszoon Forest Consulting	No	Data unavailable
James L. Able Forestry Consultants, Inc.	No	Records not available
Kent & Associates	No	Records not available
Natural Resources Mgmt. Corp.	No	No response
North Coast Resource Mgmt.	No	No response
Prielipp Consulting	No	Records not available
Ralph Osterling	No	No longer providing THP services
Shasta Land Mgmt. Consultants	No	No response
Stoneman Forestry Services	Yes	44 THPs from 1992 to 2004
Western Timber Services, Inc.	No	Records not available; provided additional information on the THP process for Table 1
William G. Apger	Yes	No response

Appendix C.2-1

Survey Form for Wood-Processing Firms

Firm Name: _____

Guidelines for completing this form:
- Select 8 THPs per year (first approved) per CDF District.
- Year corresponds to year in which THP was approved.
- Record the THP#.
- Record the cost (or person-hours spent on preparation through approval).

In order to help account for variation in THP preparation costs, we need a simple "check-off" on the following items:
- Was the sale marked or not?
- Were WLPZ concerns significant or not?
- Were wildlife or other environmental concerns significant or not?
- Indicate if the THP is associated with an SYP (S) and/or an HCP (H).

Year	THP#	Acres	Cost	Silvicultural Method 1= unmarked, 2 = marked	WLPZ 1= insig., 2= sig	Wildlife Concerns 1=insig., 2= sig	SYP=S, HCP=H
2003							
2002							
2001							
2000							
1999							

OVER

Appendix C.2-2

Survey Form for Wood-Processing Firms

Forester/Firm Name: _____

Guidelines for completing this form:
- Select 3 THPs per year (first approved) one per acreage category (small, medium and large). We have suggested some acreage breaks only as guides.
- Year corresponds to year in which THP was approved.
- Record the THP#.
- Record the charge billed to the client (Cost).

In order to help account for variation in THP preparation costs, we need a simple "check-off" on the following items:
- Was the sale marked or not?
- Were WLPZ concerns significant or not?
- Were wildlife or other environmental concerns significant or not?

Size Categories
- small (<75 ac)
- medium (75-150)
- large (>150)

Year	THP#	Acres	Cost	Silvicultural Method 1= unmarked, 2 = marked	WLPZ 1= insig., 2= sig	Wildlife Concerns 1=insig., 2= sig	NTMP
2003							
2002							
2001							
2000							
1999							
1998							
1997							
1996							
1995							
1994							
1993							
1992							
1991							
1990							

OVER

Appendix C.3

Descriptive Statistics and Graphs of THP Data

Table C3-1. Descriptive Statistics on ACRES

ACRES	
Mean	378
Standard Error	36
Median	73
Mode	40
Standard Deviation	881
Minimum	1
Maximum	7065

Table C3-2. Frequency Response on Dichotomous Variables

Variable	*No*	*Yes*
MARKED	351	256
WLPZ (Significant)	422	185
WILDLIFE (Significant)	456	151
PLAN (Long-term Plan in-place)	464	143

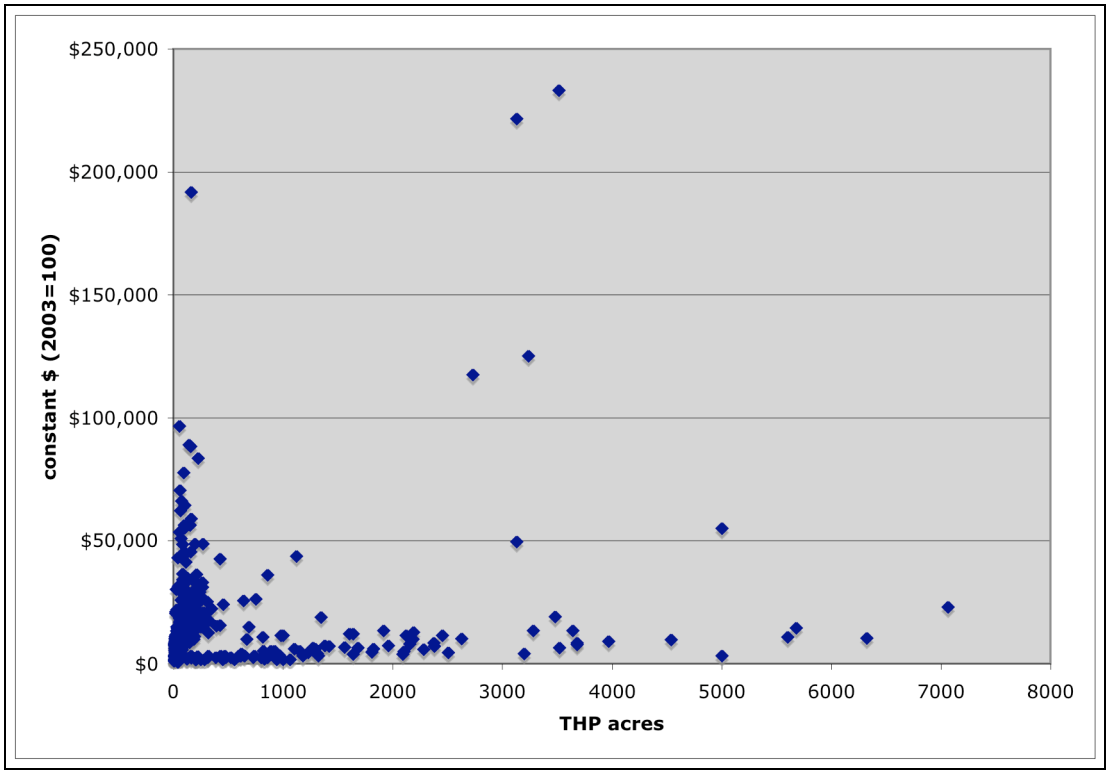


Figure C3-1. Plot of THP Preparation Costs (in constant dollars) vs. THP acres

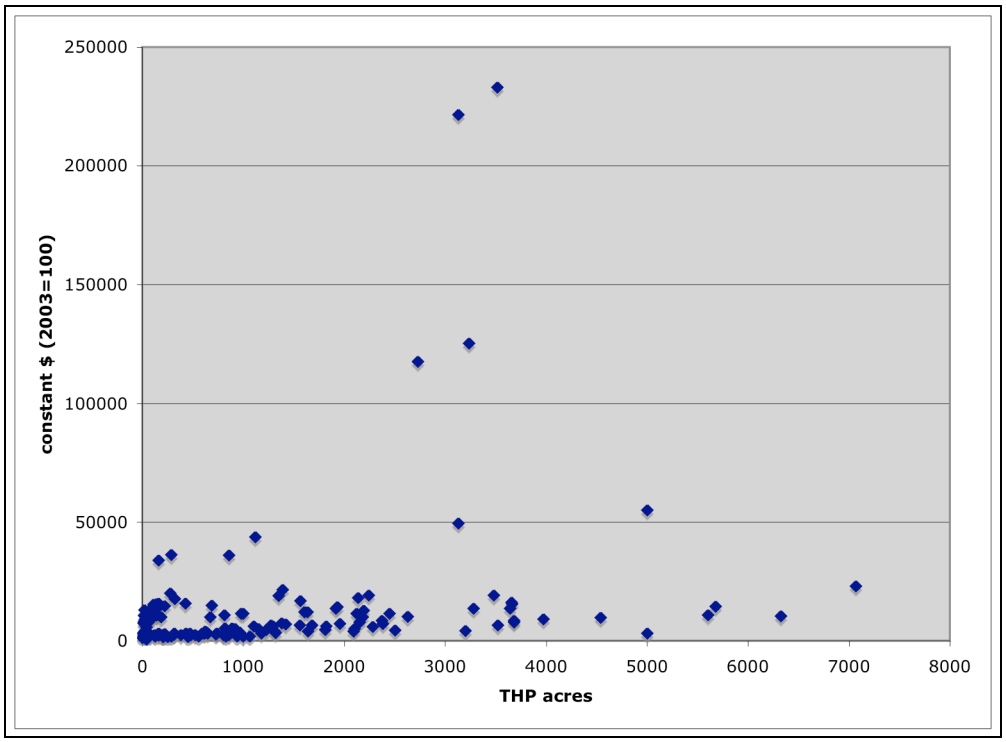


Figure C3-2. Plot of THP Preparation Costs (in constant dollars) vs. THP acres occurring in the Northern and Southern CDF Districts

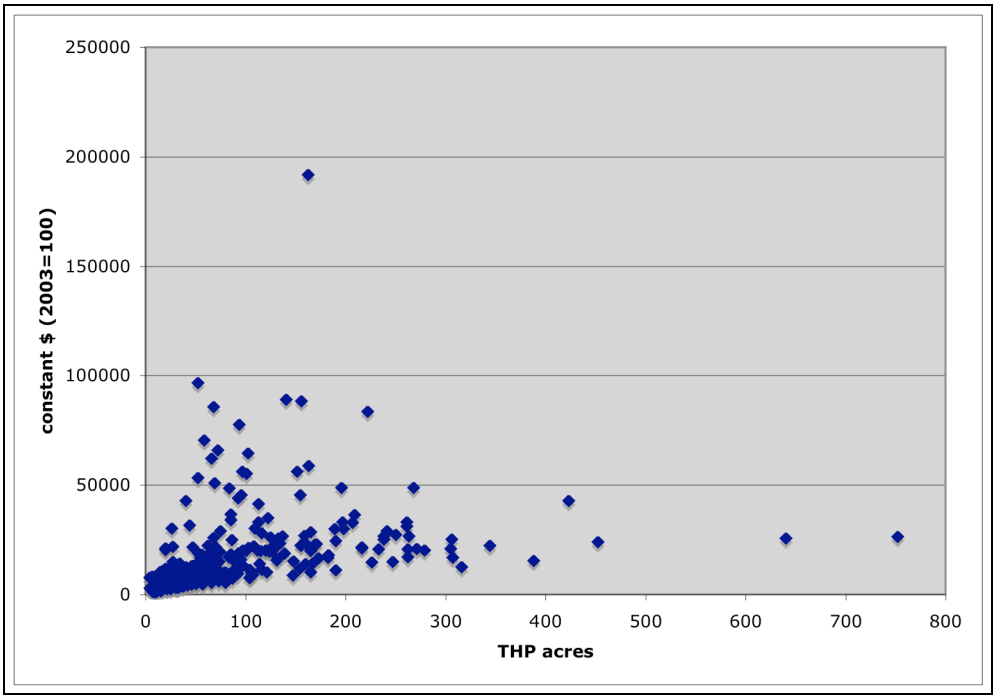


Figure C3-3. Plot of THP Preparation Costs (in constant dollars) vs. THP acres occurring in the CDF Coast District

Appendix C.4

Statistical Analysis of THP Data
Semi-log Model

Model Summary, Dependent Variable: LNCOST

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.845	.714	.710	.48470634	1.407

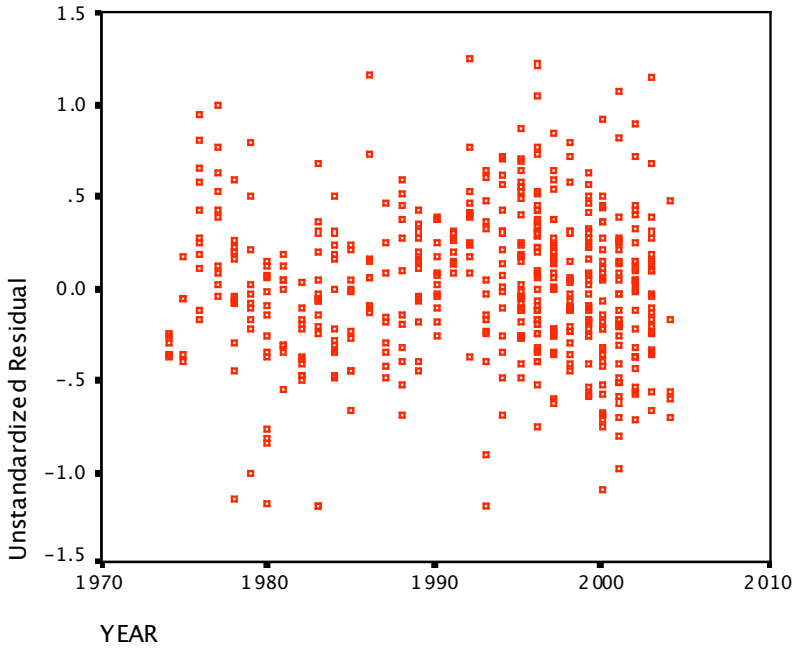
a Predictors: (Constant), YRDMMY, ACRES, MARKED, WILDLIFE, PLAN, N, S, WLPZ, YEAR

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	349.959	9	38.8844	165.5077	.000
	Residual	140.259	597	0.2349		
	Total	490.219	606			

Dependent Variable: LNCOST

	Unstandardized Coefficients				Collinearity Statistics	
Variables	B	Std. Error	t	Sig.	Tolerance	VIF
(Constant)	-63.436720	10.51967	-6.03029	2.869 E-09		
YEAR	0.0357745	0.00531	6.73276	3.916 E-11	.201	4.971
ACRES	0.0001361	2.817 E-05	4.83171	1.723 E-06	.629	1.589
N	-0.5312693	0.06112	-8.691890	3.433 E-17	.565	1.771
S	-0.0912499	0.12878	-0.708545	0.4788833	.732	1.365
MARKED	0.0970915	0.05064	1.917056	0.0557076	.619	1.616
WLPZ	0.4378362	0.06140	7.130071	2.910 E-12	.484	2.064
WILDLIFE	0.2062748	0.06168	3.344031	0.0008774	.544	1.837
PLAN	0.1957316	0.05305	3.689496	0.0002452	.764	1.309
YRDMMY	0.4450336	0.08679	5.127574	3.971 E-07	.221	4.523



Appendix C.5
Statistical Analysis of THP Data
Semi-log Model with First Order Autoregressive Process

Regression using a first order autoregressive process adds an additional variable, AR1, that lags the error term by one time period ($e_t - e_{t-1}$). Unlike Ordinary Least Squares (OLS) where estimation is conducted using an deterministic solution with well-known properties, an autoregression is estimated using a Generalized Least Squares (GLS) algorithm that consists either of a maximizing a likelihood function, or by using an iterative approach that minimizes the model error. As such, traditional OLS goodness-of-fit measures are not as precisely determined in GLS, e.g., R^2 and the F-statistic. Despite R^2 not being bounded from 0 to 1 as in OLS, we calculated it for comparison. The SSE (residual sum of squares) from OLS was reduced in GLS reduced from 140.259 to 127.412, equivalent to an R^2 (1- SSE/TSS) gain of about 2.6% (OLS R^2 was 71.4% and GLS is about 74%). Another goodness-of-fit measure for demonstrating model improvement is to show a reduction in the standard error of the regression (a.k.a. RMSE). The GLS model reduced the OLS standard error from 0.4847 to 0.4623. Finally, another comparative goodness-of-fit criteria is Akaike's Information Criteria (AIC) where model improvements are indicated by a reduction in AIC. OLS AIC was reduced from 3020.7 to 2964.4 with GLS.

The statistical significance of each variable can be determined in one of several ways. The most common is to use the "Approx. Prob." (a.k.a. p-value) which is interpreted as the percent error made in concluding that the **B** coefficient is different from 0. For example, the Approx. Prob. for **MARKED** is .1027, implying that there's a slightly greater than 10% change, or one is slightly less than 90% confident, that its **B** (.08706) is different from 0.

Adjusted sum of squares =	140.25932 (beginning value from OLS)
Number of residuals	607
Standard error	.46232437
AIC	2964.4 (calculated as n•ln(SEE) + 2(#parameters)

Analysis of Variance

	DF Adj.	Sum of Squares	Residual Variance
Residuals	596	127.41280	.21374382

Variable	B	SEB	T-RATIO	APPROX. PROB
AR1	.311885	.039224	7.9514832	.00000000
YEAR	.038499	.007136	5.3953043	.00000010
ACRES	.000125	.000028	4.5066795	.00000793
N	-.526700	.072041	-7.3111322	.00000000
S	-.036419	.121231	-.3004115	.76396807
MARKED	.087061	.053271	1.6343047	.10272295
WLPZ	.374341	.060703	6.1668069	.00000000
WILDLIFE	.181391	.063008	2.8788463	.00413453
PLAN	.204133	.062772	3.2520059	.00121064
YRDMMY	.423486	.118257	3.5810714	.00037010
CONSTANT	-68.735702	14.134731	-4.8628941	.00000148