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The Market Context of National Forest Planning

David N. Wear

THE MARKET CONTEXT OF NATIONAL FOREST PLANNING

David N. Wear[1]

I. INTRODUCTION

Ten years ago, the U.S. Forest Service began the process of planning the management of the national forests as required by the Forests and Rangeland Renewable Resources Act of 1974[2] (RPA) as amended by the National Forest Management Act of 1976.[3] While the law specified a five-year schedule for completion of the process on all national forests, a significant court decision[4] and a new administration's rewriting of the planning regulations[5] have already doubled this period of planning. Now, while most plans are under appeal by numerous parties, nearly all are in final form. Therefore, it is a good time to take stock of the planning process to date with regard to the actual management of national forests under these plans and the forthcoming second round of forest planning.

The objective of this paper is to examine the broader, market consequences of the production decisions which comprise national forest plans. To date, plans have been undertaken at the national forest level without explicit consideration for the decisions made on neighboring forests and the production behavior of other forest owners. In essence, the forest planning process has viewed individual national forests as independent firms in competitive resource markets. However, because national forests do not act as profit maximizers, this view of the national forests and markets may not be internally consistent. If it is not, then estimates of the

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1. Research Forester, U.S. Department of Agriculture, Southeastern Forest Experiment Station, Research Triangle Park, North Carolina. Dr. Wear received his Bachelor's Degree in Botany with honors from the University of Montana in 1981. Two years later, he received his Master's Degree in Resource Systems Science from Duke University. In 1987, Dr. Wear returned to the University of Montana and earned his doctorate in Forest Management and Economics. The author delivered a version of this paper at the Eleventh Annual Public Land Law Conference, University of Montana School of Law, Missoula, Montana, April 29, 1989. The views expressed in this paper are those of the author and do not necessarily represent the official views of the U.S. Department of Agriculture.

2. Pub. L. No. 93-378, 88 Stat. 476 (1974)(codified as amended at 16 U.S.C. §§ 1600-14 (1982)).

3. 16 U.S.C. §§ 1600-87 (1982).

4. In 1982 the Ninth Circuit Court of Appeals ruled that the Roadless Area Review and Evaluation (RARE II) process had not addressed an adequate range of alternatives. California v. Block, 690 F.2d 753, 765, 676-79 (9th Cir. 1982). Previously, National Forests had based wilderness designations in Forest Plans on the results of RARE II. This decision required reconsideration of wilderness designation in the forest planning process and some plans required redrafting.

5. National Forest System Land and Resource Management Planning, 36 C.F.R. § 219 (1988)(These regulations were issued September 30, 1982, and superceded those issued September 17, 1979. 47 Fed Reg. 43037-43052 (1982)).

effects of production decisions, especially as they are collected across forests, may be incorrect. This paper addresses the following essential questions: 1) what is the role of the U.S. Forest Service in defining resource markets, and 2) how can this role be accounted for in the planning process?

Forest-level planners must view the world from two perspectives. One is towards the ground, to the ranger districts which comprise each national forest and to the actual activities which comprise forest management. Here, there are the following key issues: how and to what degree can a forest plan direct these activities to achieve the desired forest? Answers to these questions require an examination of the information content of a strategic forest plan and the information needs of operations planning or scheduling. The second view of the forest planning environment is towards resource markets. These markets are often defined by the actions of the agency. This view requires an examination of the effect of production decisions on local economies. This in turn must include a study of all the market players in an area, including private ownerships as well as neighboring national forests and other public forests.

These views involve respectively reducing and broadening the spatial scale of forest-level planning. As with any political boundary, the definition of a national forest is arbitrary in both biophysical and market terms. For example, the size of a typical national forest is somewhere between an operational unit for timber management, perhaps a single, self-contained transportation system, and a timbershed, the area which is within the operational reach of a timber processing center. Typically, several timber management units comprise a forest and several forests comprise a timbershed. In addition, the optimal scale of management for other resource services may differ greatly from that for timber. For example, elk management zones must embrace winter, summer, and transitory ranges as well as wallows and other special areas. The boundaries of forests have evolved over the history of the Forest Service, and their current definition likely reflects a compromise between political realities and operational needs for managing the various resources, all conditioned on Forest Service budgets.

Within the last four to five years, the Forest Service has begun to supplement national forest-level planning with analysis at other levels. These are in addition to the RPA assessments which have had a significant bearing on forest planning from the start.[6] These new layers of analysis

6. The results of national resource assessments are applied in two important ways: a) projections of prices for resource output are defined by national models and b) recreation outputs from these assessments are used to estimate and project use on each forest. For a discussion of the assessment of RPA values for recreational outputs, see *RPA Values for Recreation: Theory and Practice* by John Duffield in this issue.

have arisen largely in the case of timber, and have addressed both the operational and the market views of forest planning. Operational or implementation issues have been addressed using various economic analysis tools for designing economically efficient forest development plans,[7] and they have been conducted at a timber management unit scale. In addition, *ex post facto* analyses of the effects of forest planning decisions on regional timber markets have recently been conducted.[8] The emergence of these studies within the agency is at least tacit recognition of the importance of analysis at various spatial levels in the overall planning effort.

This paper focuses on the market view of national forest planning by examining the combined influence of national forest plans in the resource markets in which they operate.[9] In particular, attention is focused on the markets for timber. This emphasis is justified because a) timber production remains a dominant topic of debate and the subject of much litigation, and b) it is the only major commodity produced by the national forests which trades in a well-defined market. This emphasis is not meant to imply that the market context for other services is less important. Rather, national forests likely have a greater influence over the regional markets for other services such as recreation. The results for the timber case can be extended to these other services.

The overall plan of the paper is as follows. The first section describes the Forest Service approach to planning. The second examines the market view implied by planning. The third section defines the mechanics of regional timber markets. The fourth section examines the contrast between the effects that planning decisions may have on the structure of timber markets and the structural assumptions embodied in the forest planning process. The paper concludes with a discussion of the consequences of misidentifying the market problem and how an analysis of regional markets could be used with forest-level planning. In particular, an additional regional level of analysis is proposed.

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7. These have been referred to as area or implementation analysis tools and show great promise for improving the efficiency of forestry investments and harvests. *See* Jones, Hyde, and Meacham, *Four Analytical Approaches for Integrating Land Management and Transportation Planning on Forest Lands*, U.S. DEP'T OF AGRIC., FOREST SERVICE RESEARCH PAPER NO. INT-361 (1986). For further discussion on suitability analysis see *Economic Suitability of Lands for Timber Production: A Proposed Rule of Reason* by David Jackson in this issue.

8. These studies have been conducted in at least two regions. The State of Montana and Region 1 of the Forest Service (Montana and Northern Idaho) cosponsored a market analysis of various timber production levels taken from Forest Plans. Flowers, *Montana's Timber Supply: An Inquiry Into Possible Futures*, U.S. DEP'T OF AGRIC., FOREST SERVICE RESEARCH BULLETIN NO. INT-40 (1986). In addition, Region 8 (Southeastern U.S.) commissioned a study of the market effects of the Forest Plan for the national forests of North Carolina.

9. For a discussion of the operational or implementation view, see Jackson, *Economic Suitability of Lands for Timber Production: A Proposed Rule of Reason* in this volume.

II. The National Forest Planning System

The planning of national forests is possibly the most difficult application of natural resource economics to date. Several factors which contribute to its difficulty are significant: a) forests are used by society to a variety of ends and many uses are incompatible with others, b) because most of the national forest system is concentrated in rural western states like Montana, public planning decisions can have a profound effect on local economies, c) resource tradeoffs must be evaluated with imperfect information on the values of many resources, d) the actual resource tradeoffs are unclear because the production responses of forests to management are uncertain, and e) the complexity of the problem creates an enormous number of production alternatives. The national forest planning process is an attempt to structure this complex and sometimes ambiguous resource management problem in a way which leads to well-informed decisions.

The primary tool for forest planning analysis is an optimization model called FORPLAN.[10] It is used to bring together data to describe a national forest, the production relationships which describe how the forest will develop and respond to different management activities, the values of different resource outputs, and the costs of management. The model is solved using an optimization approach which defines an economically efficient management plan for the forest.[11] This reduces the decision space by eliminating from consideration the many suboptimal management plans which could achieve the same level of outputs. Of course, the degree to which a solution actually reflects an optimal plan depends on the construction of the model.

While the modeling exercise is well-structured and extensive, the extent to which the planning analysis can inform professional judgment depends critically on how well decision-makers understand the limits and implications of their planning models. The solution to a FORPLAN model is mechanical but its construction and the interpretation of its results are largely subjective exercises, and they clearly depend on the judgment of planning teams and decision-makers. Much of this interpretation depends upon testing the sensitivity of the model to ranges of assumptions regarding uncertain values. The analysis of the several benchmarks and production alternatives undertaken in the forest plans helps define this sensitivity.[12]

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10. FORPLAN is an acronym for Forest Planning Model. The design and use of this model has been the topic of much of the literature regarding forest planning over the last ten years.

11. Most FORPLAN models are designed to solve for the maximum discounted value of forest management. It is possible to solve for the maximum of any output. For example, it is possible to solve for maximum timber or recreation output.

12. Benchmarks are analyses which estimate the production potential for various resource outputs under a minimum level of management required for the forest. In effect, these are used to define

Cost/benefit analysis undertaken with a FORPLAN model addresses the relative efficiency of forest management alternatives and attempts to define that management plan which gives rise to the highest net discounted benefits. In addition, forest planning clearly addresses distributive or equity questions as well.[13] These distributive issues, often encapsulated as a "community stability" policy, are largely concerned with a redistribution of resource wealth from the public at large to the rural areas which are dependent on public forests for input to their wood products industries.[14] These concerns for local production levels and their derivative employment and income are often used to justify departures from the efficient solutions defined by cost/benefit analysis. The tool for examining these employment and income effects is IMPLAN,[15] an input-output model which describes the historical impacts of forest outputs on local economies and projects the economic impacts of various production alternatives.

Planning decisions are ultimately the product of synthesizing the results of cost/benefit analysis, impact analysis, and professional judgment. The resulting plans have essentially four components. One is the land allocation, or quite simply, the map of prescribed land uses. The second is a set of management standards that guide the design and execution of management activities on the forest. The third is an output schedule that is consistent with the land allocation, management standards, price and cost inputs to the analysis, and the objectives of the alternative. Fourth, because of uncertainty in resource data, production relationships, and prices and costs, a monitoring plan is also required. It is used to a) test whether the "output schedule—land allocation—management standards" triad is

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the potential range of production alternatives for managing the national forest. *See* 36 C.F.R. § 219.12(e)(1) (1988). Production alternatives are developed in accord with requirements of the National Environmental Policy Act of 1969. 36 C.F.R. § 219.12(f) (1988); *see generally* 42 U.S.C. §§ 4321-4370 (1982). A good general discussion of benchmarks and alternatives is presented in Morrison, *The National Forest Management Act and Below Cost Timber Sales: Determining the Economic Suitability of Land for Timber Production*, 17 ENVTL. L. 557, 567-578 (1987).

13. The classic justifications for public intervention in a free market economy are efficiency, stability, and equity. The efficiency justification for public forest management — arising, for example, from timber production externalities — is well established. *See e.g.*, Krutilla and Haigh, *An Integrated Approach to National Forest Management*, 8 ENVTL. L. 373 (1978). The use of equity criteria to direct public forest management is not nearly as clear. *See, e.g.*, Schallau and Alston, *The Commitment to Community Stability: A Policy or Shibboleth?*, 17 ENVTL. L. 429 (1987). However, the importance of equity considerations in the outcome of Forest Plans is clear in planning documents. *See, e.g.*, U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, BITTERROOT NATIONAL FOREST FINAL ENVIRONMENTAL IMPACT STATEMENT, APPENDIX B (1987); BITTERROOT NATIONAL FOREST RECORD OF DECISION (1987).

14. Time and space does not allow for a discussion of the statutory and administrative history of the community stability policy. An exhaustive study of the policy can be found in Schallau and Alston, *supra* note 13, at 435-466.

15. U.S. DEP'T OF AGRIC., IMPLAN VERSION 1.1: ANALYSIS GUIDE (1985). IMPLAN is an acronym for Impact Planning Model.

internally consistent, b) examine the plausibility of key assumptions used in the resource modeling, and c) compare the projected future with actual outcomes. In sum, monitoring should define when planning results are no longer germane, triggering amendments to forest plans or new planning analysis.

III. The Market View in National Forest Planning

Forest planning addresses production decisions at a forest level using two economic analyses: a cost/benefit analysis using FORPLAN and an impact analysis using IMPLAN. While each national forest plans separately without explicit consideration for its market interactions, a market view is implied by the structure of these analyses. The cost/benefit analysis using FORPLAN views each national forest as a typical producer in natural resource markets. That is, each forest is assumed to not be able to influence total production in these markets and, therefore, its production decisions can have no bearing on resource prices. The impact or distributional analysis using IMPLAN does, however, imply considerable market power of individual national forests. When each forest compares the derivative jobs for its alternative production levels, the implication is that the forest is omnipotent in resource markets, directly defining total production and employment levels. The extent of the market power actually held by most national forests likely falls somewhere between these two extremes.

Alternative market structures for use in forest planning have been discussed to a limited degree. The discussion has centered on whether a downward sloping demand curve should be applied in FORPLAN models instead of the horizontal demand curves that are currently used.[16] There are theoretical as well as computational implications of this approach. Using a downward-sloping demand curve would imply that each national forest would control total production in its market area. If this is the case, and it likely is in a few localized situations such as the east side of the Rocky Mountains in Montana, the approach is correct, but only with some important modifications. To simply replace the horizontal demand curve with a downward sloping curve and solve the FORPLAN solution would lead to a monopoly solution.[17] This would result in reduced production and

16. This discussion applies more generally to the application of linear programming models to forest planning problems. *See* J.L. Walker, An Economic Model for Optimizing the Rate of Timber Harvesting, (1971) (Unpublished Ph.D. Dissertation available from the University of Washington), *and* Chappelle, *Linear Programming for Forestry Planning*, in Forestry and Long Range Planning, 129 (F.J. Convery and C.W. Ralston ed., Duke University School of Forestry and Environmental Studies (1977)).

17. A "horizontal demand curve" indicates that the producer (the National Forests in this case) faces a fixed price at any level of production. A downward-sloping curve refers to the standard market

higher prices relative to a competitive solution. In total, this would suggest increasing public timber revenues at the expense of timber consumers. In order to account for total consumer and producer benefits, the objective function for the FORPLAN model would need to be adjusted accordingly.[18] The difficulty with this approach is computational. Because the objective function changes from a linear to a nonlinear equation, the size of the problem which can be solved practically is greatly reduced.

In most cases, however, the actual structure of the problem lies between the extremes of a powerless and an omnipotent resource supplier. Because the agency does not typically control the entire resource base in a region, it cannot directly control production. However, where the agency controls a large share of the resource base, its actions likely have some influence on the production decisions of private producers so that total production may be controlled indirectly. If this is the case, then an examination of direct effects alone is inadequate. Because changes in public production may lead to changes in private production, the total influence of forest planning decisions may not be captured in individual forest plans.

IV. THE MECHANICS OF REGIONAL TIMBER MARKETS

The role of the Forest Service in certain timber markets is extraordinary. It is unique because only in the case of forestry does the federal government take such a large and active role as a resource producer in an otherwise private market. The national forests contain the largest share of the nations's softwood sawtimber (47% in 1987), and the share is much higher in some subregions.[19] Because of this dominance and because of a multiple-use agenda which allows the agency to operate at a financial loss in many areas, the Forest Service cannot be considered a typical timber producer. Indeed, in many cases, planning decisions largely shape markets for timber. Therefore, they should hold at least some influence over timber production from other ownerships and consequently determine market prices for timber.

A discussion of the role of the Forest Service in timber markets is best built as a departure from the perfectly competitive case. A market is the place where producers and consumers interact and establish production

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level description of demand, where price declines with the level of production. This is the situation faced in a market with a single producer—a monopoly.

18. The appropriate objective function for this kind of planning problem was defined by Samuelson, *Spatial Price Equilibrium and Linear Programming*, 42 AM. ECON. REV. (1952).

19. For example, the agency controlled 71% of the softwood sawtimber in the Rocky Mountain States in 1987. These figures were derived from U.S. Dep't of Agric., U.S. Forest Service, An Analysis of the Timber Situation in the United States: 1989-2040, Part I: The Current Resource and Use Situation, C-62 (1988) (unpublished review draft).

levels and prices. In the case of timber, the outcome is timber harvest levels and timber prices. Putting aside the public role in these markets for the moment, consider first the actions of private timber producers and consumers which would define timber supply and demand, respectively, in a perfectly competitive market.

Timber demand at the regional level is derived from the national market for wood products. For a small production region, the demand for delivered logs is dependent on prices for products, such as lumber and plywood, determined in national and perhaps international markets and on local manufacturing costs. The value of the logs in production is the value of the lumber and other outputs produced minus all the relevant production costs. Logs are consumed by wood products manufacturers who adjust their demands for logs and other inputs such as labor and machines, based on the prices of products, logs, and these other inputs. The same demand relationship holds for labor as well as any other input; employment in local wood products industries is dependent not only on national product prices, but also on local wages and timber prices.

The demand for standing timber or stumpage is derived through the next step in production, logging and hauling. The value of stumpage to a logging firm is defined by the prevailing price of delivered logs and the costs of transporting standing trees to the mill yard (logging plus hauling costs). Timber consumers adjust their demands for timber and other inputs based on these prices and costs.

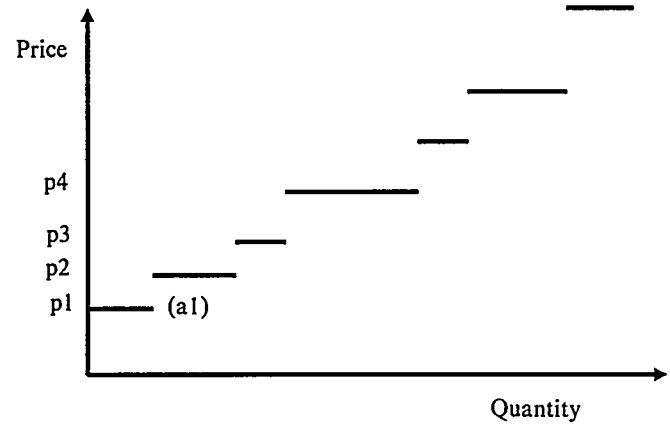
The supply of timber from forest owners is derived in a somewhat different way. The dominant question facing owners of merchantable timber is whether to harvest today or to hold onto standing timber. This decision is based on owner preferences, market expectations, and on the costs of bringing timber to market. The forest owner must decide whether the returns to harvesting today are better than the future opportunities for timber revenues.

This relationship defines how profit-seeking forest owners would respond to any set of timber prices. Consider that forests, especially in an area like the Rocky Mountains, are composed of stands of trees of various qualities and accessibility. These attributes define the costs of bringing each type of stand to market which include the cost of accessing the timber and preparing a sale. Assuming for the moment that future prices or opportunity costs are constant across these timber stands,[20] the timber supply response function is defined as the quantity of timber placed on the market for any given price of timber. An example is shown in Figure 1. At

20. This would not generally hold; because stands are composed of trees of various species with different growth rates, their expected future values will differ. However, this simplification of the argument does not reduce the generality of the conclusion.

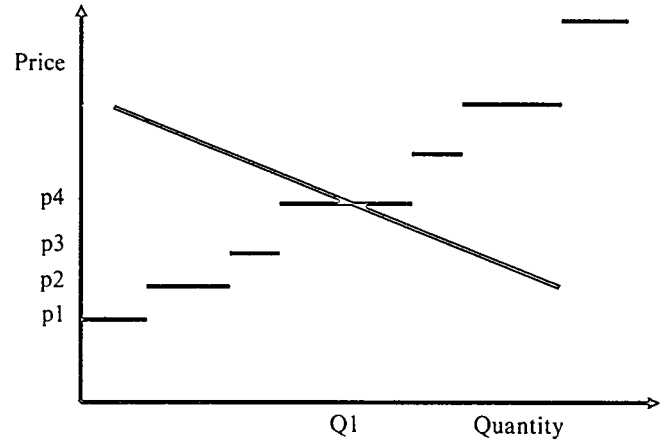
some minimum price (p1), forest owners will produce timber from a certain quality/accessibility class (a1). Production begins when the market price is equal to p1, which is the opportunity cost plus the cost of bringing timber of class a1 to the market. As the price rises (to p2,p3, and so on), more costly timber classes are brought to market.

Figure 1. A timber supply response function for a hypothetical timber market.



If we apply a demand curve to Figure 1, then the market is completely defined (Figure 2). The quantity of timber produced is defined where the demand price for timber—the value of the derived products minus the costs of logging, hauling, and manufacturing—is just equal to the supply price—the opportunity costs of harvesting plus the marketing costs. Our key assumption is that the market is perfectly competitive, so that all producers and consumers seek to maximize their profits from timber production and that no producer or consumer is large enough to influence the market. If such a case holds and externalities do not exist, then the theory of welfare economics indicates that social welfare is well served by this solution, that the net discounted benefits arising from timber production is at a maximum.

Figure 2. A timber market solution defined by the intersection of the supply response function and a timber demand curve.



V. The Forest Service Role in Timber Markets

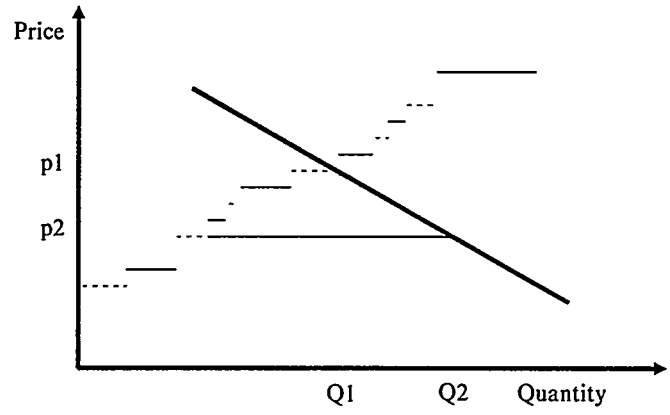
Extending this analysis to include Forest Service production requires adjusting some of the basic assumptions. The Forest Service is not bound to a profit-maximizing behavior because of the important externalities involved in the production of timber and because of other objectives guiding public land management such as the distributive goals discussed earlier.[21] Because of this difference in motives and the large share of timber stocks controlled by the agency in some regions (primarily in the western states), production decisions on the national forests will change the shape of a supply response function. This, in turn, will feed back to the production decisions of other producers.

When the assumption of a profit motive for a major timber producer is dropped, the behavioral basis for the supply response curve shown in Figures 2 and 3 is lost. Because the agency makes decisions based on non-market as well as market concerns, the amount of timber brought to market is no longer based strictly on marketing and opportunity costs. For example, the Forest Service may decide to depart from efficient production

21. *See supra* text accompanying notes 12-14.

levels to address distributive goals.[22] This redefines the shape of the timber supply response function because some timber is brought to market at a price that does not cover marketing and opportunity costs. Therefore, and quite regardless of motive, the agency may control the aggregate supply response in a region. The mechanics of this control are shown in Figure 3 where some timber is produced at less than its supply price (opportunity costs plus marketing costs). Here, the supply response function from Figures 1-2 is shown, but with the timber produced by public and private forest owners identified separately. This additional information defines, for our hypothetical situation, the harvest by each ownership for any price scenario. Two market solutions are shown in Figure 3. The first (marked p1,Q1) is the standard market solution defined in Figure 2. The second (marked p2,Q2) is a modified solution, where the Forest Service has placed timber on the market at a price that does not cover all marketing and opportunity costs.[23]

Figure 3. Two market solutions. One is the competitive solution, the other is where the Forest Service forces timber onto the market. The solid portion of the timber supply function is Forest Service output; the dashed private.



The consequences of this type of market intervention are clear from Figure 3. Total harvests increase from Q1 to Q2 and the price of timber

22. *See supra* note 13 and accompanying text.

23. Note that the agency need not lose money in the short run to have this effect. The price received may well cover the cost of marketing the timber but not the opportunity cost. While below-cost sales are a part of this set, sales which cover costs but not the future value of the stumpage have the same effect.

falls from p1 to p2. This price change would, in turn, have two effects. The total output from private lands would decrease by the quantity that would have been placed on the market at prices between p1 and p2. This, coupled with the increase in public timber harvests, would increase the total proportion of public timber harvesting in the region. In addition, because timber becomes relatively less expensive than labor, the ratio of labor to timber employed in the production of wood products might decline. Thus, cheaper timber would be substituted for labor.[24]

The market model defined here has been greatly simplified to focus on the important interactions between producers. It has been abstracted from the important intertemporal aspects of forest plans and timber supply. The time dimension enters the problem in two ways. First, private owners respond, not only to current production levels, but also to their perceptions of what future production and prices might be. These expectations regarding future markets may greatly influence current plans. The second effect addresses the condition of the resource itself. In the western United States, forestry is in a transition between mining an essentially nonrenewable old-growth forest and an agricultural forestry enterprise. The rate of harvest for high-quality old growth by various owners will greatly influence production levels and prices during this period.[25] Therefore the inventory and condition of timber stocks will also hold influence over production plans.

While extending the time horizon of the market analysis adds considerable complexity, it does not change the overall result; private timber production decisions will be influenced by public decisions. Accordingly, the total production of timber in a region and the price of timber will be influenced by national forest production decisions, not only directly through the availability of national forest timber, but also indirectly through the effects of these decisions on regional timber prices. The extent of these influences is proportional to the share of timber held by the agency and the condition of public and private inventories.

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24. Slight substitution possibilities between labor and timber have been demonstrated for the Montana wood products industries. Wear, *Structural Change and Factor Demand in Montana's Wood Products Industries* (submitted for publication in 19 CANADIAN JOURNAL OF FOREST RESEARCH (1989)). This kind of effect on employment cannot, however, be captured in input/output models such as IMPLAN.

25. In many locations, there may be a gap between the exhaustion of old-growth and the maturing of second-growth forests on private lands. An important question is how will this kind of gap influence local economies? A germane question for Forest Service planners is how should agency production plans address these gaps using the "departures" from even-flow harvesting which are discussed in the NFMA? *See* 36 C.F.R. § 219.16(a)(3) (1988).

VI. LOOKING AHEAD

Understanding and applying alternative market structures in forest planning will require the work of researchers and forest planners. The job for researchers is to define the extent and mechanics of private/public interactions in resource markets. The study of timber markets should be extended to consider the inventories of and interactions between all timber producers in regional markets. This will require a careful examination of historical data to determine the structure and extent of private responses to public production decisions.[26] When this has been accomplished, the difference between the current, forest-by-forest approach to planning can be compared with one which includes a regional market assessment. The process would involve a regional layer of analysis between forest plans (directed by NFMA) and national assessments (directed by RPA) which can specifically address regional market structures. Such an analysis could foster two results. First, it could add precision to the estimation of local prices and therefore influence land allocation to timber production based on suitability criteria. Second, it could address the distributive issues of timber production at a timbershed or timber market level that includes private as well as public production. The cost/benefit and distribution analyses would then be based on the same market assessment. The tradeoffs between land allocations and jobs would then be more clearly defined.

The challenge for planners would be to integrate forest-level and market analyses in a regional planning system.[27] The structure of such a planning system would likely be iterative, cycling between the forest-level and the regional market level. Current plans could be used in such a system by deriving supply response functions for each national forest from existing FORPLAN models. These could be aggregated at the regional level along with similar information for private and other public ownerships.[28] If the results of a regional analysis indicate significant shifts in the prices applied in forest-level analyses, then the changes could be made and the process repeated.

Another consequence of this approach is that it could address the comparative advantages of different national forests for timber production. Because of the variety of forest types and accessibility conditions in

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26. A cooperative study between the University of Montana and the Southeastern Forest Experiment Station is currently investigating this question using Montana as a case study.

27. Regional Guides, as defined by the NFMA regulations, are intended to "provide standards and guidelines for addressing major issues and management concerns which need to be considered at the regional level to facilitate forest planning." 36 C.F.R. § 219.8(a) (1988).

28. Inventories of timber on private ownerships are periodically taken by Forest Inventory and Analysis Research Units within the Forest Service. These can be used to support this kind of analysis.

places like Montana, different forests within the region may have cost advantages for producing timber. Likewise, different forests may hold a comparative advantage in producing recreation opportunities and other services. A regional level of analysis would allow production to be orchestrated across forests, possibly reducing the costs of maintaining even-flows of timber from all forests.[29]

Some market-level studies have been developed to examine the possible effects of national forest plans on local economies. They have been *ex post facto* in nature, simply examining the effects of a change in total production levels. These previous studies have not directly examined the interaction of public and private timber producers. Market models that actually address these interactions could provide a more precise view of the economic effects of national forest production and could provide a method for coordinating production decisions across forests.

29. This regional analysis could potentially ameliorate the declining even flow effects described by McQuillan in *The Declining Even Flow Effect—Non Sequitur of National Forest Planning*, 32(4) FOREST SCIENCE 960 (1986).