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ECONOMIC SUITABILITY OF LANDS FOR TIMBER PRODUCTION: A PROPOSED RULE OF REASON

David H. Jackson¹

I. INTRODUCTION

The Forest and Rangeland Renewable Resources Planning Act² (RPA) as amended by the National Forest Management Act³ (NFMA) introduced the necessity of utilizing economic analysis in national forest management decision-making. While there have been some interesting publications regarding the broad philosophical approach that Congress intended the Forest Service to use in land management,⁴ Congressional intent is unclear on some particularly important matters regarding economic analysis and the suitability of lands for timber production.

Section 14 of RPA/NFMA formalized the practices in timber harvest scheduling that the Forest Service had chosen to use under the broader guidance of the Multiple Use-Sustained Yield Act.⁵ Section 14 included the additional requirement that the schedule of future harvests could not decline.⁶ Thus, sustained yield is a nondeclining schedule of future harvests.⁷ But the new requirement related to harvest scheduling that has become a source of confusion regarding legislative intent is concerned with which portion of a national forest's lands should be included in the base for harvest scheduling. Section 6(k) of RPA/NFMA, the suitable lands provision, directs the development of forest plans for each national forest. It states:

In developing land management plans pursuant to this act, the Secretary shall identify lands within the planning unit which are not suited for timber production, considering physical, economic, and other pertinent factors, to the extent feasible as determined by the Secretary, and shall assure that, except for salvage sales or

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2. Pub. L. No. 93-378, 88 Stat. § 476 (1974) (codified as amended at 16 U.S.C. §§ 1600-1614 (1982)).

3. 16 U.S.C. §§ 1600-1687 (1982).

4. Krutilla and Haigh, *An Integrated Approach to National Forest Management*, 8 ENVTL. L. 373 (1978).

5. 16 U.S.C. §§ 528-531 (1982).

6. 16 U.S.C. § 472(a) (1982).

7. Parry, Vaux and Dennis, *Changing Conceptions of Sustained Yield Policy*, 81(3) J. FORESTRY 150-54 (1983).

sales necessitated to protect other multiple-use values, timber harvesting shall not occur on these lands for a period of 10 years.⁸

The section goes on to state that unsuitable lands will continue to be treated for reforestation purposes. In addition, the Secretary of Agriculture can reevaluate this land classification in subsequent forest plans based upon new information and return lands to timber production when they have become suitable for such purposes.⁹

Operational criteria for determining the suitable lands will clearly influence the number of acres of forest land, the volume of standing timber in the base for scheduling timber harvests and the resulting harvest level or schedule. Somewhat less clear, however, is the meaning of the term "economic" in the context and Congressional intent of the legislation. Before proposing an appropriate criteria for determining the economic suitability of lands for timber production, both the term "economic" and the confusion regarding Congressional intent will be examined in detail.

II. ECONOMIC ANALYSIS

In the context of the law, the Forest Service must conduct some kind of economic analysis in determining unsuitable lands. Economic analysis itself represents a form of modeling. Any kind of modeling involves a simplified representation of important aspects of a real world problem, process, choice, or situation formulated for the purpose of analysis and understanding. The "art of modeling" requires the analyst to glean the essential elements which characterize the subject matter while simultaneously discarding the nonessential elements which tend to confuse or obscure the situation. Indeed, while likely not stated as such, legal arguments represent a form of modeling. Thus the question demanded by section 6(k) is what kind of model should the Forest Service use?

Two forms of analysis are often employed to model resource allocation decisions. Efficiency analysis determines the best combination of resources to be employed in achieving social well being. Distribution analysis is often used to analyze the impact of a change in production or resource allocation in terms of the interdependent relationships between industries or sectors in an economy or region. The former is concerned with calculating the largest possible gain in societal benefits relative to societal costs, and the latter is concerned with tracing changes in transactions through an economy or region. This latter analysis is used to determine the effects of changes on economic aggregates such as employment and income both within a particular industry or sector and across the several sectors of the

8. 16 U.S.C. § 1604(k) (1982).

9. *Id.*

area being examined.

In effect, two different issues are addressed. In efficiency analysis, there are three related questions. First, do societal benefits exceed societal costs? Second, can a given level of societal benefits be produced at a lower cost or can more societal benefits be produced at a given cost? Third, would the difference in societal benefits and costs be improved by changing the level of production?

In distribution studies, the analysis focuses on the interdependence between economic activities and the primary and induced consequences of changes in circumstances. For instance, the change in the availability of timber will affect production in the timber using industries, and this will in turn have a ripple effect due to changes in workers' incomes, their purchases of goods and services in other sectors, and a change in the purchases by the timber companies of such items as logging equipment from other industries. The changes in income and employment in the wood using industries are primary effects. The changes in employment and incomes in other industries that result from the primary effects are called secondary or induced effects.

At times efficiency analysis may be used in analyzing choices of predetermined and non-priced goals. For instance, "[T]he United States pledged itself as a sovereign nation in the international community to conserve to the extent practicable the various species of fish or wildlife and plants facing extinction,"¹⁰ One can identify the most "cost effective" way of accomplishing this goal without explicitly valuing the species at issue. Hence, efficiency analysis can be useful in accomplishing goals even if the equivalent monetary value of the goal (for instance, the value of the snail darter) is unknown. Efficiency analysis is useful in directing choices to a particular alternative for accomplishing an end.

Efficiency analysis and the study of distributive effects are often seen as forms of economic analysis that are non-additive. One might wonder whether inefficiency can be justified by certain desirable distributive consequences. Since more equality in incomes is also valued, and if there are tradeoffs between efficiency and distributive equity, what appropriate welfare criteria should be used in making decisions? Because society values more equality in incomes in addition to efficiency, Okun argued:

. . . neither takes absolute priority over the other, then, in places where they conflict, compromises ought to be struck. In such cases, some equality will be sacrificed for the sake of efficiency, and some efficiency for the sake of equality. But any sacrifice of either has to be justified as a necessary means of obtaining more

10. 16 U.S.C. § 1531(a)(4) (1982).

of the other (or possibly of some other valued social end).¹¹

Of particular importance to national forest planning are the national and regional distributive consequences of various alternative programs. Since the national forests are located primarily in the Western United States, and the fiscal system both for funding national forest activity and for bankrolling commodity receipts is the national treasury, the distributive consequences lie across both sectors and regions.

III. ECONOMIC SUITABILITY: THE SOURCES OF CONFUSION

A. *Legislative Intent Behind the Suitable Lands Provision*

Some members of Congress originally intended a strict and narrow test of economic suitability to guide harvest scheduling, while others apparently did not.¹² A proponent of the strict test, Senator Dale Bumpers, credited his views to the testimony of Dr. Marion Clawson, a well known resource economist. Clawson based much of his testimony before the Senate Committee on his publication concerning the efficiency of national forest management that was subsequently placed in the hearings record. Clawson argued, "[A] great national asset was poorly managed and unproductive."¹³ His views were based on his findings that "expenditures for timber management are being made in regions, on forests and on sites where timber values are so low that the areas should be abandoned for timber growing purposes."¹⁴

As a means of demonstrating that the Forest Service was spending too much on lands of low site quality, Clawson offered some rudimentary estimates of timber management expenditures on national forest lands with differing growth productivity classes. However, Wilkinson and Anderson's charge that "he specifically opposed managing timber on lands capable of growing less than fifty cubic feet per acre per year — known as site V land"¹⁵ is an unfortunate misinterpretation of his views. In response to a question from Senator Bumpers, Clawson stated:

11. A. OKUN, *EQUALITY AND EFFICIENCY: THE BIG TRADEOFF*, 88 (1975).

12. C. WILKINSON AND H. M. ANDERSON, *LAND AND RESOURCE PLANNING IN THE NATIONAL FORESTS* 162-170 (1987).

13. Clawson, *The National Forests*, 191 *SCIENCE* 762 (1976).

14. *Id.* at 965.

15. Wilkinson and Anderson, *supra* note 12, at 163 (discussing SUBCOMM. ON PUBLIC LANDS OF THE SENATE COMM. ON INTERIOR AND INSULAR AFFAIRS, *CLEARCUTTING ON FEDERAL TIMBERLANDS* 3-4, 92ND CONG., 2D SESS. (Comm. Print 1972), reprinted in *FOREST AND RANGELAND MANAGEMENT: JOINT HEARINGS BEFORE THE SUBCOMM. ON ENVIRONMENT, SOIL CONSERVATION, AND FORESTRY OF THE SENATE COMM. ON AGRICULTURE AND FORESTRY AND THE SUBCOMM. ON THE ENVIRONMENT AND LAND RESOURCES OF THE SENATE COMM. ON INTERIOR AND INSULAR AFFAIRS*, 94TH CONG., 2D SESS. 953-54 (Comm. Print 1976) [hereinafter cited as *SENATE NFMA HEARINGS*]).

I am saying if it is below fifty, in other words class 5, generally speaking in most cases, it is uneconomical to grow timber. Now there are all kinds of exceptions, because a lot would depend on the species, the quality, the accessibility to markets, the existence of existing roads, so you can get timber out more cheaply and so on. So I would not say every acre.¹⁶

Clawson recognized that the quality of the land and its role in influencing timber growth was an important but not exclusive factor affecting the efficiency of national forest timber management. Rather, location, road construction, and the value of the wood should also be considered or included in the analysis of the management situation.

Disagreement over the wording of the suitable lands provisions among members of the Subcommittee on Forests lead to no expressed provision in their version of the bill which originally passed the House.¹⁷ In part, the inability to agree on language was due to a concern of some committee members with a "loss of timber supply that might result from the Senate's cost-benefit test."¹⁸

Representative Foley proposed the compromise language to the Congressional committee that became law.¹⁹ This section requires "a process for estimating long-term costs and benefits to support the program evaluation requirements of this act."²⁰ Senator Bumpers, who proposed the Senate's specific test of costs and benefits, "reportedly studied the House language over night and concluded that it would accomplish what he had first proposed."²¹ Thus, the more general language of economic suitability became law rather than the more stringent words requiring a narrowly defined test of revenue efficiency.

Hesitancy in accepting the Senate's cost-benefit test version of the bill because of potential loss in timber supply is an important point. Clawson had delivered the news that many large areas of reasonably unproductive

16. Clawson, SENATE NFMA HEARINGS, *supra* note 15, at 279; *see also*, Clawson *supra* note 13.

17. H.R. 13,236, 94th Cong., 2d Sess. (1976), *reprinted in* HOUSE COMM. ON AGRICULTURE, 94TH CONG., 2D SESS., BUSINESS MEETINGS ON NATIONAL FOREST MANAGEMENT ACT OF 1976 (Comm. Print 1976).

18. H.R. Rep. No. 1478, pt. 1, 94th Cong., 2d Sess. 36, *reprinted in* SENATE COMM. ON AGRICULTURE, NUTRITION, AND FORESTRY, 96TH CONG., 1ST SESS., COMPILATION OF THE FOREST AND RANGELAND RENEWABLE RESOURCES PLANNING ACT OF 1974 at 611 (Comm. Print 1979) [hereinafter cited as the RPA COMPILATION].

19. Section 6(k) was proposed by Representative Foley, Chairman of the House Committee on Agriculture. Address by Robert E. Wolf of the Congressional Research Service of the Library of Congress presented at the 11th Annual Public Land Law Conference, Missoula, MT, April 28, 1989.

20. S. Rep. No. 1335, 94th Cong., 2d Sess. 28-29, *reprinted in* RPA COMPILATION, *supra* note 18, at 756-57.

21. Letter from Robert E. Wolf to Charles Wilkinson (Dec. 11, 1984); *see, e.g.*, WILKINSON AND ANDERSON, *supra* note 12, at 166 n. 851.

national forests might not be harvested if the cost-benefit test were strictly enforced. This news raised, among some members of Congress, issues of interdependency consequences that are the subject matter of distributional analysis. Timber supply from the national forests traditionally implies a social mission of maintaining "community stability" by creating a reliable long term source of logs. This stability, in turn, is intended to maintain jobs in the communities where the mills procuring the logs are located.

The lack of specificity regarding the term "economic" led the Committee of Scientists, which was established by the NFMA to recommend management regulations, to conclude that Congressional intent surrounding the term was unclear.²² Wilkinson and Anderson appear to agree in stating, "The Committee of Scientists probably has put it best by concluding that Section 6(k) allows administrative flexibility but that the Forest Service is constrained by a 'rule of reason' when uneconomical sales are involved."²³

Before turning to the proposed rule of reason presented in this paper, it is important to briefly discuss the role of each national forest plan developed under Section 6 guidance in the larger RPA/NFMA planning process.

B. *Forest Planning in a National Context*

By way of introduction, the law prescribes planning and economic analysis to take place at three analytical levels, the national level, the forest level and the level of the individual timber sale project. Sections 3(a) and 3(b) direct the Forest Service to conduct national resource assessments and identify the ways and means to achieve a balance in the supply and demand of renewable resources.²⁴ Based upon the assessment and identification of alternatives, Section 4 directs the Secretary of Agriculture to prepare a Recommended Renewable Resources Program for the President.²⁵ Section 8 then states, "The President shall . . . carry out programs already established by law in accordance with such Statement of Policy, or any subsequent amendment or modification thereof. . . ."²⁶ Finally, Section 4, in defining the nature of the Renewable Resource Program, indicates that it will contain program recommendations which "state national goals that recognize the interrelationships between and interdependence within the renewable resources"²⁷

22. *Final Report of the Committee of Scientists*, 44 Fed. Reg. 26,599, 26,607 (1979).

23. WILKINSON AND ANDERSON, *supra* note 12, at 170.

24. 16 U.S.C. § 1601(a), (b).

25. 16 U.S.C. § 1602.

26. 16 U.S.C. § 1606(a).

27. 16 U.S.C. § 1602(5)(D).

Hence, planning on each national forest is part of a larger planning framework. In order to frame the role of each national forest plan in the larger system of plans, Section 6 introduces forest planning for the various units (national forests) as follows:

(a) As a part of the program provided for by section 3 of this Act, the Secretary of Agriculture shall develop, maintain, and as appropriate, revise land and resource management plans for units of the National Forest System,²⁸

Clearly, no forest is an island. The preceding section indicates that each unit or forest is a component of a larger national program. The system has national goals and directions that are directed by the Chief Executive. These key components of RPA/NFMA are some of the most important apparent roots for the choice of regulatory rules the agency uses in implementing the suitable lands section of RPA/NFMA. We now turn to an examination of how the Forest Service has chosen to implement the suitable lands clause.

IV. IMPLEMENTING THE SUITABLE LANDS PROVISION

Given the confusion regarding the intent of Congress in enacting the suitable lands provision, the Service's approach to developing regulations was likely difficult. The actual regulations provide a series of screenings before arriving at a land base suitable for timber production. First, non-forest land and lands that are not physically suitable for timber production are removed from the land base.²⁹ The former include grasslands or other non-forest lands such as lakes or granite mountain tops, and the latter might be highly prone to irreversible damage should they be logged. In addition, lands that can not be restocked within five years (in reference to section 6(g)3(E)) and lands that have been withdrawn for other reasons, such as wilderness or research natural areas, are also withdrawn from the suitable land base.³⁰

A second screening grid defines additional acres as "tentatively suitable". This grid includes the following categories: (1) lands that the Forest Service is proposing for Wilderness, (2) lands that must not be logged to protect other resources such as water quality or endangered species, and (3) "the lands which are not cost-efficient, over the planning horizon in meeting forest objectives, which include timber production."³¹

In effect, no lands are withdrawn from the timber base for economic

28. 16 U.S.C. § 1604(a).

29. 36 C.F.R. § 219.14 (1988).

30. *Id.*

31. *Id.* at § 219.14(c).

efficiency reasons prior to harvest scheduling. If there are not enough lands in the timber base to efficiently meet RPA/NFMA timber objectives, lands will be brought into production that lose money. Clearly, the Forest Service has avoided using the kind of narrowly constructed cost-benefit test proposed by Senator Bumpers in the Senate version of the bill. Perhaps more interestingly, the Forest Service has chosen to use the cost effectiveness approach to efficiency analysis.

The apparent Forest Service interpretation of the law might be stated as follows: whether or not the timber program pays for itself in the sense of receipts and expenditures, RPA/NFMA calls for a national program and goals that are directed by the President of the United States. If the President directs the accomplishment of a set of production goals, and Congress funds it, the agency will deliver in the most cost-efficient manner possible. In short, the Forest Service has elected to leave the definition of the suitable lands to a *de facto* decision of the Chief Executive by allowing the choice of budgets and RPA goals to reveal the most cost effective lands suitable for timber production. In this manner, the Forest Service can assume the role of a loyal civilian army which is highly responsive to the President.

While the impetus for the suitable lands provision originated with a concern for eliminating inefficient resource allocation, the agency has elected to model some of the distributive consequences of each forest plan alternative.³² These distributive consequences are simply estimates of direct and indirect income and employment resulting from the conversion of the forest's timber into products. Obviously, the estimates vary with the different acreages of land placed in the suitable timber base.

While a forest plan may allude to the budget requirements for each planning alternative, the Forest Service analysis overlooks the regional and national consequences of the forest budget on employment and income. Since the Forest Service budget comes from the national budget, regional estimates of jobs and income appropriately ignore the low local consequences of differing national budgets. From an economy wide perspective, however, the tax consequences of alternative Forest Service budgets likely reduces aggregate demand. The agency's expenditures currently exceed receipts by roughly \$1 billion annually. Thus, higher agency costs can be seen as increasing taxes and/or debt and reducing household demand for goods and services both in the current periods and in the future, since so much of the budget is now financed with debt.

32. The Forest Service model for observing distributive effects is known as the Impact Planning Model, or IMPLAN. For more detailed information on IMPLAN, see Alward and Palmer, *IMPLAN: an Input-Output Analysis System for Forest Service Planning*, U.S.D.A. Forest Service Publications (1985).

The forest level modeling of employment and income is unbalanced with an equivalent national analysis. Forest plans leave a false impression that the jobs and income produced at higher harvest levels on individual forests have no adverse distributive consequences at the national or economy-wide level. In addition, no explicit mention is made of the efficiency-equity tradeoffs. Numbers are simply displayed in tables. The efficiency costs of higher employment are not addressed and cannot be addressed without the interregional consequences of alternative budget levels on national income and employment.

In effect, no specific test for the economic suitability of lands is conducted prior to scheduling timber harvests. National goals and objectives can force the inclusion of a considerable amount of unprofitable land in the timber base.

V. PROBLEMS WITH THE CURRENT SUITABLE LANDS REGULATIONS

At first glance, the current, official interpretation of the suitable lands policies is both simple and compelling. However, the current approach can be faulted on three specific grounds. The first two problems summarize the previous discussion, and the third problem arises as a conflict between the current approach and other provisions of the law.

1. No economic suitability test is used to withdraw lands from timber production prior to harvest scheduling.

2. Decisions to use inefficient lands must be justified in terms of equity considerations. The Forest Service ignores the interregional equity consequences of alternative budgets and, hence, uses incomplete data in arriving at forest plan judgments.

3. Inclusion of lands that are inefficient in terms of an excess of costs over benefits can lead to adopting harvest schedules which violate the nondeclining even-flow provisions of Section 13 of RPA/NFMA.³³

The third problem, first recognized by McQuillan, occurs under the following situation he described and termed "the declining even-flow effect."³⁴ First, a forest includes some negatively valued timber in the planning base along with timber which can pass the strict efficiency test. This might easily occur as a result of meeting the RPA timber management goals identified in the President's program. Next, suppose that the forest uses FORPLAN, its linear programming model, to schedule timber harvests. Because of the particular mathematical formulation of FORPLAN, harvests on the positively valued lands occur at the beginning of the

33. See, 16 U.S.C. § 1611 (1982).

34. McQuillan, *The Declining Even Flow Effect—Non Sequitur of National Forest Planning*, 32 FOREST SCIENCE 960-63 (1986).

plan, and negatively valued harvests occur at the end of the planning horizon. Indeed, if there were sufficient positively valued land to meet the RPA goals, no negatively valued land would be included in the land base for harvest scheduling.

But the problem of including negatively valued timber in the base for harvest scheduling occurs when the forest plans are renewed. RPA/NFMA requires a periodic renewal of forest plans essentially at least every 15 years.³⁵ McQuillan argued that even if planners have perfect foresight, it will not be possible to maintain the level of harvest in future forest plans. As time passes, the negatively valued timber stands loom closer in the planning horizon. They contribute more negatively to the net present value of the forest plan. Under these circumstances, the forest will schedule each new plan at a lower level of harvest than the last one. This is the declining even-flow effect.³⁶

Many economists and resource professionals questioned the wisdom of nondeclining even-flow as poor capital management.³⁷ Other parts of the law may not make good sense in terms of efficient capital management such as harvesting at culmination of mean annual increment,³⁸ or the necessity of five-year reforestation success.³⁹ However, the remedy available to the executive branch, if it does not like aspects of the law, is not to dodge legislative intent. Rather, it seems more appropriate to seek amendments to the RPA/NFMA.

VI. PROPOSED CRITERIA FOR A RULE OF REASON

Given the problems with the current approach to implementing the suitable lands provision, a rule of reason designed to solve the problems is appropriate. Prior to pronouncing a proposed rule of reason, however, a set of criteria used to evaluate the adequacy of the rule must be presented. This set includes the following elements.

1. The kinds of economic models used to determine the lands suitable for timber production should extend as a logical consequence of the Congressional mandates for land management. Policies for implementing the suitable lands provision should not conflict with other legislative mandates. Instead, they should augment or integrate other legislative

35. 16 U.S.C. § 1604(f)(5).

36. Dennis E. Teeguarden, an original member of the Committee of Scientists, recognized the importance of McQuillan's contribution in terms of suitable lands in *Benefit-Cost Analysis in National Forest System Planning: Policy Uses and Limitations*, 17 ENVTL. L. 393, 424 (1987).

37. See, e.g., Samuelson, *The Economics of Forestry in an Evolving Society*, 14(4) ECONOMIC INQUIRY 466-492 (1976); J. HIRSCHLEIFER, INTEREST, INVESTMENT AND CAPITAL 1-320 (1970); D. JACKSON, THE MICROECONOMICS OF THE TIMBER INDUSTRY 1-136 (1980).

38. 16 U.S.C. § 1604(m) (1982).

39. 16 U.S.C. § 1604(g)3(E)(iii).

directives.

2. There should be a demonstrable test indicating why a particular site is suitable while another is not before including the land in the base for harvest scheduling.

3. The inclusion of the terms "physical" and "other pertinent factors" in addition to the term "economic" in section 6(k)⁴⁰ suggests that one does not necessarily have to demonstrate the increment in social efficiency for all consequences of potential timber land use. A narrow revenue efficiency test may be considered.

4. Certainly the costs and benefits which vary from site to site such as the existence of roads or need to access, cost of reforestation and site productivity must be included in the determination of suitable lands. One of the key components of RPA/NFMA was the development of sound information for budgeting and planning. Information for suitable lands analysis should reflect this kind of concern.

5. By all logical estimates, the most valuable capital asset in determining lands suitable for timber production is the standing timber itself. The costs of managing national forest timber must reflect the realities of water, wildlife, recreational opportunities and other uses which may compete with or complement timber production. In analyzing lands suitable for timber production, the analysis must include the existing timber, the value of the land in growing timber, the costs of growing timber and the returns associated with multiple use timber management.⁴¹

6. There is mounting evidence that the national forests are comparatively unproductive because of agency decision-making which consistently ignores the most efficient management alternatives. This is particularly true in developing forest transportation networks. Jones, Greg, Hyde and Meacham demonstrated that current approaches for choosing road access links to timber stands are not cost effective in comparison to optimal patterns of development.⁴² In general, they estimated that forest managers make development pattern choices in partially roaded areas costing taxpayers roughly \$100/acre in discounted costs. Considering that there are about 8 million acres alone of Montana's national forest land currently in the base for harvest scheduling (a substantial share is "partially roaded"), uneconomical patterns of development are likely vast. Contrary to the intent of Congress, current roading and payment practices reduce

40. 16 U.S.C. § 1604(b).

41. R. Benson and M. Niccolucci, *Cost of Managing Non Timber Resources When Harvesting Timber in the Northern Rockies*, (rev. ed. September 1985) (U.S.D.A. Forest Service, unpublished research paper, INT-351).

42. J. Jones, J. Greg, F. Hyde III, and M. Meacham, *Four Analytical Approaches for Integrating Land Management and Transportation Planning on National Forest Lands* (rev. ed. 1986) (U.S.D.A. Forest Service, unpublished research paper, INT-361).

timber value over viable alternatives.⁴³ The Forest Service must use economic efficiency analysis when plotting roads to serve scheduled harvests or other resource values.

7. The suitability of lands for timber production should not be judged solely by using the direct revenues and costs on a sale-by-sale basis. This would eliminate all "below-cost" timber sales. However, some below-cost timber sales are justifiable on an investment basis because the roads to such sales access other profitable sales using the same roads. Below cost sales must recognize the investment nature of forest development.⁴⁴

8. Inefficient timber production which has a substantial net impact on more equal distribution of income and wealth in the U.S. can be justified on the basis of fairness. The net effects of income distribution must include the effects of taxation in timber production as well as the income and jobs produced attendant with timber harvesting. National standards should be established that will define an acceptable efficiency cost of more equity.

VII. THE RULE OF REASON: A MODELING OUTLINE

The following model is a simplified approach to determining economic suitability of timber lands. The essence of this model is to determine the operational stocks of timber, similar to estimating the profitable ore in a gold mine.⁴⁵ Currently, the Forest Service has supported the development

43. The Forest Service plans to road another 600,000 acres of currently roadless lands. In this endeavor, the RPA/NFMA directs "the installation of a proper system of transportation to service the National Forest System, . . . shall be carried forward in time to meet anticipated needs on an economical and environmentally sound basis . . ." 16 U.S.C. § 1608(a) (1982). The National Forest Roads and Trails System Act declares the importance of establishing roads to "increas[e] the value of timber and other resources tributary to such roads, . . ." 16 U.S.C. §§ 532-538, 532(1) (1982). However, contrary to the apparent intent of Congress, there is again growing evidence that road requirements in timber sale contracts actually help create market circumstances where timber offerings receive no bids and hence the standing timber has no market value in exchange. See, M. Niccolucci, *A Quantitative Analysis of Sold and Unsold Timber Offerings in the Northern Region* (1989) (Draft Masters Thesis, University Montana, Missoula Montana); Jackson, *Why Stumpage Prices Differ Between Ownerships: A Statistical Examination of State and Forest Service Sales in Montana*, 18 J. FOREST ECOLOGY AND MANAGEMENT 219 (1987); Jackson, Sendak and Gould, *Federal Timber Auctions, Limited Bidding, and the Economics of Wallflowers*. (September 1989) (draft article submitted for publication in FOREST SCIENCE).

44. See, e.g., *Below Cost Sales and Improvements in Forest Service Efficiency: Hearings on Economics of Federal Timber Sales Before the House Subcomm. on Forests, Family Farms, and Energy*, 99 Cong. 1st Sess. 926-945 (1985) (statement of David Jackson); also *An Analysis of the Appropriateness of Below-Cost Timber Sales on the National Forests: Hearings Before the House Subcomm. on Forests, Family Farms and Energy*, 99th Cong. 1st Sess. 42-89 (1985) (statements of J. Jones and E. Schuster).

45. See, D. Jackson, *An Integrated Resource Management Approach to Defining Operable Timber Stocks* (1983) (symposium proceedings); *Management of Second-Growth Forests The State of Knowledge and Research Needs* 253-269 (O'Laughlin & Pfister eds. 1980) (available from Montana Forest and Conservation Experiment Station, University of Montana, Missoula, Montana).

of two operational models which solve the problem in different ways.⁴⁶ There are other models designed to conduct similar analyses.⁴⁷ Thus, while the approach is simplified, problems of greater complexity can and have been solved using these models.

Figure 1 illustrates a typical timber development area with variable timber suitability across the area. To demonstrate the nature of the problem, suppose that there are three different qualities of logging opportunities: Low (l), Medium (m), and High (h). Let the existing roads be denoted as the solid lines while the dotted lines represent the potential routes to access the various timber stands. Note that some stands may be accessed in more than one way and only some of the dotted lines will actually become forest roads. The problem to be solved involves deciding which timber stands and access roads should be built, and when the roads should be built and the timber logged.

Solving this problem requires some important additional data. For instance, what is each stand of timber worth and what are the long term costs and benefits associated with reforesting the land following logging? What will each road segment cost to construct? How will logging be constrained to limit adverse side effects, or to enhance complementary positive impacts? How do timber prices and construction projects, when merged together, impact timber prices?

This problem is very different from the usual FORPLAN formulation of a forest plan and harvest schedule. The essence of this approach is a site specific analysis of the development alternatives. It requires an investigation of areas that are logical planning units. This model would use estimates of the actual costs of building road segments to actual timber stands, the actual timber values and potential harvest prescriptions that influence value.

FORPLAN does allow a limited analysis of specific areas, although it is seldom if ever used in developing forest plans. Costs and revenues in FORPLAN are placed in tables with costs varying to some degree with forest conditions. For example, the table of road construction costs in a forest data base in FORPLAN might have various costs assigned for the different classes of sideslopes and roadway widths. Since FORPLAN does not link each timber stand with a road link of a particular length, sideslope, or roadwidth, it is not possible to determine what the direct costs and

46. See, McQuillan, *Economic Valuation of Timber Potential for Undeveloped Forest Land Using a Modified Dynamic Programming Algorithm* (1985) (Stoors Summer Conf. AMSE, Stoors, CT); M. Kirby, P. Wong, W. Hagar and W. Huddleston, M.E. *Guide to the Integrated Resource Planning Model* (1981) (U.S.D.A. Forest Service, Mgmt. Sci. Staff, Berkeley, CA); see also Jones, Greg, Hyde and Meacham, *supra* note 42.

47. J. SESSIONS, *NETWORK ANALYSIS USING MICROCOMPUTERS FOR LOGGING PLANNING* (1985).

benefits are of accessing particular timber stands. Figure 1 can be useful in demonstrating some important points concerning access costs and timber suitability. Refer to the area in the middle righthand side of the map. It is identified with a star and labeled (l), suggesting that it is a low quality logging opportunity. Clearly, this stand will be accessed as a part of the effort to gain access to high quality logging sites. If any logging is to take place in the entire area, access will be gained through this stand. If the rule is imposed that sites cannot be logged if site quality is low, this area will not be logged, even if it is roaded to gain access to the rest of the timber that pays its way into the area. Roading and logging this mapped area requires a calculation of the area benefits and costs, not the costs and benefits of sites in a non-geographic or locational context.

A second stand of interest is at the lower right hand portion of the map and is again marked with a star, but labeled (h), indicating that it is a high quality logging opportunity. By itself, one might think that this timber is a suitable candidate for logging. However, it is surrounded by timber (as is shown) that is of poor quality and the road costs to access all of the stands including the one in question are possibly quite high. This whole area may be too expensive to access because the good timber in the area in question may not be worth enough to warrant a series of access sales that would lose money beyond the value of the good timber.

As previously discussed, different mathematical programming approaches have been developed to solve these kinds of problems.⁴⁸ These models yield extraordinary improvements in efficiency over conventional approaches to making these kinds of decisions. Some sales will produce less revenue than the costs of roading and selling the timber and still be efficient. Since roads will often be used to access sales other than the sale at hand, low quality sales may represent wise expenditures of public funds.

These modelling approaches will reduce the costs and increase the price of timber over current management approaches because roads will be built more parsimoniously.⁴⁹ If the costs and benefits included in FORPLAN data bases reflect the true and current management scenario, use of the area approach to determining suitable lands would make current costs and benefits in FORPLAN too conservative. Some of the negatively valued timber included in the base to meet RPA goals would be positive in value if the Forest Service were to use these approaches to determine suitable lands. Therefore, this approach is no panacea for environmental interests intending to prove that the Forest Service is including too many acres in the base for timber production.

48. See D. Jackson, *supra* note 45; also J. Sessions, *supra* note 47.

49. J. Bowman, National Forest Transportation Planning, (1982) (unpublished manuscript available from the author at Chequamegon National Forest).

The conventional approach to area development is plainly inefficient. Conversely, the proposed approach provides a test of revenue efficiency while allowing lands to be included in the base for timber production that would not be included if they were analyzed in terms of current classification systems. In addition, the proposed approach saves the taxpayer countless dollars by increasing efficiency in a system with poor or non-existent area planning.⁵⁰

If the Forest Service adopts area planning approaches that yield efficient solutions, its net receipts would increase drastically. Lands that produce revenue losses under current management would not do so under efficient management regimes. There is an interaction between sale design choices inclusive of road construction requirements due to sale location, the number of bidders that are willing to participate on a given Forest Service timber auction, and the market price of the winning auction bid.⁵¹ Better area planning through more prudent development decisions will generally result in fewer miles of road construction per million feet of timber sold, greater bidder interest and higher timber prices. More efficient land management would result in lower logging and development costs and higher timber prices. In summary, the Forest Services loses money more because it chooses to than because of timber quality or burdensome environmental restrictions.

The essence of area planning is to develop efficient land management. Toward this end, the Forest Service response to the problem of area planning has ignored the question of equity. At first, the resolution of these two issues is not readily apparent. As McQuillan pointed out, it is possible to compare the marginal contribution of individual stands to the total value of the entire area.⁵² Some of the individual units may produce a positive contribution to aggregate well-being in the narrow sense of efficiency, while other areas may not. The questions regarding the efficiency/equity tradeoff are how many, if any, and which of the negatively valued units should be included in the land base for the reasons of distributive justice?

Perhaps the best way to approach the nature of this question is by referring back to the map in Figure 1. In the lower right hand side of the map, the starred timber stand is accessed by a proposed road which could be constructed beyond the good timber into stands of low and medium

50. No one has attempted to estimate the total partially roaded acres that would be affected by cost saving planning techniques. The savings of \$100.00 per acre, if applied to half of Montana's currently suitable land, would save about \$400,000,000.00. This ignores further price effects resulting from packaging roads and sales.

51. See, Jackson, *Why Stumpage Prices Differ Between Ownerships: A Statistical Examination of State and Forest Service Sales in Montana*, 18 J. FOREST ECOLOGY AND MANAGEMENT 219 (1987).

52. See McQuillan, *supra* note 46.

quality logging opportunities. Suppose that the road construction to the good timber stand (marked with the star) can be justified on efficiency grounds. Construction to the next more distant stand that is of medium logging opportunity is expected to lose a small amount of money due to relatively high road construction costs. If the entire length of road is completed to the stand of low quality logging opportunity, losses will increase substantially in the area because of low timber values and even higher road construction costs.

If the result of land development is desirable income redistribution, the costs to the federal government of redistributing income increase as lands of greater financial costs are included in the base for development. Completing the entire length of road in the example will lose more money or cost the taxpayer more than limiting road construction to the stand with the medium logging opportunity. This, in turn, will cost more than limiting the road construction to the starred timber stand. Each timber stand has an identifiable increment, either positive or negative, to the nation's wealth and well-being.

Just how much the nation is willing to lose in well-being in order to provide jobs and income has never been the explicit focus of a national policy debate, although there have been many federal programs aimed at improving the economic life of areas (Appalachia), cities and groups such as the poor. Two approaches could be used in estimating the proper terms of the tradeoffs. One approach might be referred to as the revealed preference method wherein current or prior federal programs with an explicit focus on redistribution might be examined in terms of their efficiency costs (reference to other federal programs reveals our collective preferences for redistribution of wealth).

Another approach, commonly referred to as the expressed preference approach, often relies on survey methods aimed at determining the appropriate efficiency/equity tradeoff. In the latter instance, care must be taken to construct an appropriate sample that reflects the interregional nature of the tradeoffs between federal subsidization of economic improvement in one area at the cost of increased taxation of the population at large.

Hence, the suitable land base will include those areas that produce long run positive returns in their own right, and any further lands where subsidized losses in timber production are valued due to the desirable effects of income redistribution. Quite clearly, some areas in the rural U.S. are relatively disadvantaged and one would expect more timber production losses in those areas than in others where income and employment are greater.

VIII. CONCLUSION

The problem with the current approach to defining economically suitable lands for timber production is that there is no directly demonstrable test for determining the land base prior to harvest scheduling. In effect, the Forest Service has recommended an RPA timber harvesting program to the President. Although there is no evidence that the Chief Executive has acted on these RPA goals, the Forest Service has recommended a suitable land base commensurate with its unratified goals. The economic analysis in this process amounts to a determination of the land base necessary to meet unofficial Forest Service goals in a cost effective manner.

It appears that the Congressional concern with timber supply, particularly among some members of the U.S. House of Representatives during the debate on the NFMA, lends credibility to the subsidization of timber losses to maintain supply. A proposed test which casts the subsidy into the broader framework of a tradeoff in efficiency and equity has been presented. The test is demonstrable.

A tentative land base could be developed that includes lands that pass the strict efficiency test, where benefits exceed costs, and additional lands, if any, where subsidized production could be warranted due to cost effective production of equity. With the resulting "economic" land base, traditional harvest scheduling methods could be employed to analyze and select land management alternatives. Including subsidized lands in the timber base would not compel timber production on them, particularly if land managers chose to produce some other resources on the lands. Subsidized timber production would continue as long as the income inequalities warranted it. They might well continue across successions of forest plans.

Given the apparent conflict among Congressmen concerning the maintenance of timber production as opposed to the reduction of timber production on unprofitable lands, the implementation of the suitable lands provision is almost necessarily confusing. The compromise language that became law limits the scheduling of harvests to lands that are economically suitable. It suggests a broader definition than a strict test of economic efficiency. One might ask, what kind of analysis should be used as a means of determining the suitable land base, and what did Congress mean by "economic?" The law begs the question. To this end, distributional consequences as well as efficiency effects should be used in a site specific test determining the suitable land base. The Forest Service must develop a policy for determining the appropriate rate of tradeoff between equity and efficiency as a basis for defining the lands suitable for timber production.

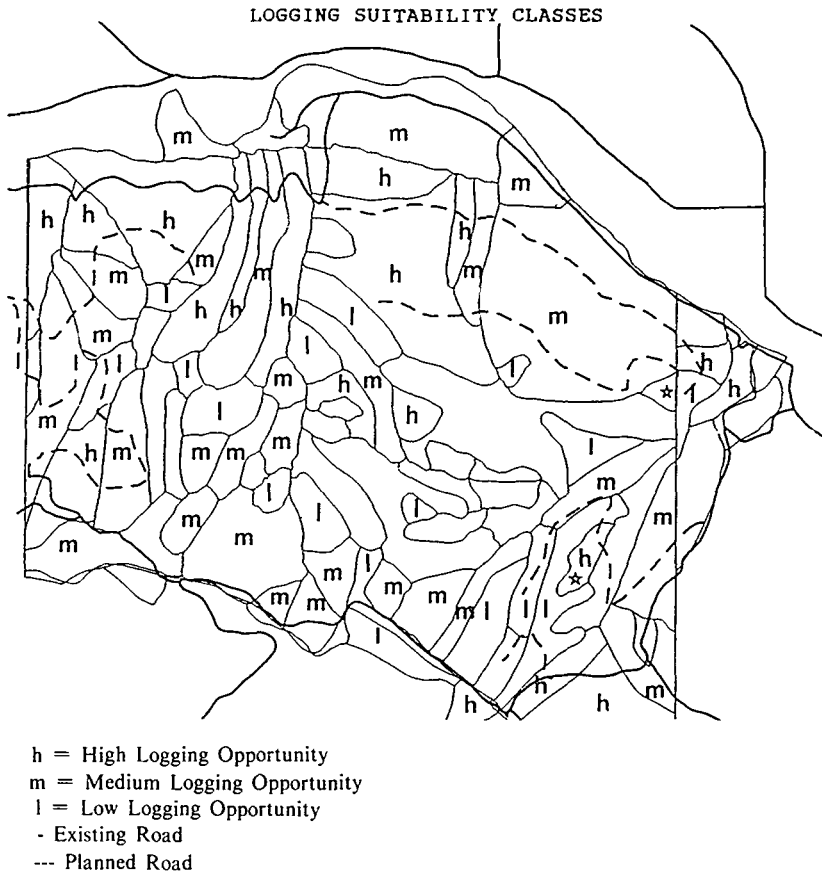


FIGURE 1