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THE PROBLEM WITH ECONOMICS IN FOREST PLANNING . . . AN OVERVIEW AT THREE LEVELS

Alan G. McQuillan¹

I. INTRODUCTION

At a meeting of forest economists in 1981, Richard Behan, University of Montana Forestry School Dean, presented a paper entitled "RPA/NFMA: Time to Punt."² In the evening fireside discussion that followed, a senior forest economist from the Washington office of the Forest Service said, "Maybe we [forest economists] promised more than we could deliver." This was a dramatic admission.

The statement is correct, and with the analysis that follows, it is clear that the problems associated with economics in the forest planning system are not the prime causes of the current impasse in implementing the National Forest Management Act (NFMA).³ Instead, fundamental problems frustrating the implementation of NFMA arise within the language of the regulations designed to implement the Act, and, beyond this, in the failure of the Forest Service to correctly interpret the true intent of Congress in formulating NFMA, the restoration of the public trust in Forest Service land management.

II. FORPLAN—DID THE AGENCY PROMISE MORE THAN IT COULD DELIVER?

The National Forest Management Act was the first legislation to enforce substantive statutory restrictions on the Forest Service.⁴ It made specific stipulations as to where timber could be harvested on national forest lands, restricted the rate of timber harvesting on those lands and made other stipulations regarding the management of non-timber resources including water, diversity of plant species, and so on.⁵ First and foremost, the Act required the agency to produce comprehensive forest plans for each and every national forest in the nation by the end of 1986 and

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2. Address by Richard Behan, Annual Meeting of Western Forest Economists (May 5, 1981).

3. 16 U.S.C. §§ 1600-1687 (1982).

4. Wilkinson and Anderson, *Land and Resource Planning in the National Forests*, 64 OR. L. REV. 1 (1985).

5. *Id.* at 371.

to repeat the planning process every fifteen years or sooner.⁶ Two of the most important decisions made in the planning process are the determination of those lands considered suitable for timber management within the forthcoming decade (the suitable timber base) and the determination of the allowable annual sale quantity (ASQ) from such lands for the same ten year period.

In the early 1970s, when the Forest Service realized that the traditional approaches toward harvest scheduling would produce a "fall-down effect" or reduction in the level of sustainable yield, the agency implemented a policy of nondeclining even-flow (NDEF) with respect to the timber harvest⁷ and adopted an ingeniously designed linear programming (LP) model for this purpose.⁸

It is not surprising that, in designing the forest planning system following NFMA, LP-literate analysts within the agency realized that they could enlarge their existing linear programming approach to harvest scheduling to embrace the broader aspects of benefit-cost analysis. The result was a sophisticated linear programming model (FORPLAN)⁹ designed to implement a maximum net present value (NPV) objective function in the presence of numerous physical and policy-related constraints. The use of NPV as the objective function allowed the adoption of the dollar as the common unit of measure and supposedly embraced long-run objectives as superior to immediate returns and cash flow.¹⁰ Maximum NPV was also the measure of economic efficiency which had received the blessing of the prominent economist Paul Samuelson.¹¹ This constrained

6. 16 U.S.C. §§ 1604(c) and (f).

7. Parry, Vaux, and Dennis, *Changing Conceptions of Sustained-Yield Policy On The National Forests*, 81 J. FORESTRY, 150 (Mar. 1983). NDEF first entered the regulations in 1963, but the old allowable cut formulas did not implement the policy. The adoption of LP-based harvest scheduling in the early 1970s allowed implementation, and the policy was reiterated in 1973 in Emergency Directive 16. Behan, *Political Polarity and Conceptual Nonsense: The Strange Case of Sustained Yield Forestry*, 8(2) ENVTL. L., 309, 339-40, (1978). In 1976, NDEF was incorporated in NFMA, Section 11. See 16 U.S.C. § 1604(m) (1982).

8. D. Navon, *Timber RAM . . . a Long-Range Planning Method For Commercial Timberlands Under Multiple-Use Management* (1971) (U.S. Dep't of Agric., U.S. Forest Service, unpublished research paper PSW-70).

9. U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, *A USER'S GUIDE TO FOREST PLANNING MODEL (FORPLAN)* 1-172 (1980).

10. The management of the national forests for the "greatest good of the greatest number in the long run" was first espoused by Forest Service founder Gifford Pinchot in 1905. The famous "Pinchot Letter" is reproduced in U.S. DEP'T OF AGRIC., *AGRICULTURAL HANDBOOK NO. 453, THE PRINCIPLE LAWS RELATING TO FOREST SERVICE ACTIVITIES* 138-9 (Sept. 1978).

11. Samuelson, *Economics Of Forestry In Evolving Society*, 14(4) ECONOMIC INQUIRY 466-492 (1976). This approach necessitates the use of discounting techniques whereby costs and benefits accruing in distant future time periods have little impact on the solution. It is generally agreed that future generations have a large stake in the management of our nation's forest lands. Some argue that Adam Smith's guiding hand works intertemporally so that landowners maximizing current land values

maximization approach to planning decisions appeared to offer the best of two worlds. The primary objective was economic efficiency in a broad multiple-use sense, and the model also allowed the incorporation of non-economic considerations through a manipulation of the myriad constraints entered into each run of the FORPLAN model.¹²

With FORPLAN, forest economists hoped to deliver the optimal solution to the problem of allocating national forest lands to what might be called their "highest and best use." This allocation was to be considered not in terms of strict cash flow-based efficiency, but in terms of broad social welfare as measured by "net public benefits," including the recognition of externalities and the provision of amenities and public goods which are not valued on the open market. Theoretically, the agency could use the harvest scheduling capabilities of FORPLAN to ensure that the land allocations and scheduled activities within each allocation were consistent with the long-standing principle of sustained yield.¹³ Thus, FORPLAN's optimal solution was to be efficient both spatially (in terms of which lands are allocated to what activities) and temporally (in terms of the scheduling of activities to comply with sustained yield over the long run).

To produce such a model is a monumental task, a task not dissimilar to that faced by the rulers of centrally planned economies such as the pre-*glasnost* Soviet Union.¹⁴ All of the usual problems of benefit-cost analysis arise, but on a larger than usual scale. These will be reviewed briefly.

Since national forests are managed for multiple goals, the agency must first reduce these goals to a single unifying objective function (such as maximum NPV) with the attendant problem of measuring as many outputs as possible using a single measure of system performance (dollars).¹⁵ In FORPLAN, so-called priced outputs can include not only those commodities where one can, in principle, observe prices in the market (primarily timber for harvesting and range for grazing of domestic

do indeed take care of future generations. See Stroup, *Planning And Freedom Of The Individual*, in *PERSPECTIVES IN RESOURCES PLANNING* 74 (A. McQuillan ed. 1977). Others argue that discounting, by its very nature, shortchanges the interests of future generations. Personal correspondence from Chandler Morse, Professor Emeritus of Economics, Cornell Univ., Ithaca, NY (1976). Some of the effects of discounting's failure to allow for future costs are seen, for example, in the benefit cost analysis of a proposed hydroelectric dam. Costs of major repair and maintenance work which do not have to be borne for five decades do not figure largely in the analysis. Yet the press has lately been rife with stories of the multi-billion dollar costs that the public faces for repair and maintenance of aging hydroelectric plants, nuclear facilities and similar technological wonders of past eras.

12. See U.S. DEP'T OF AGRIC., *supra* note 9.

13. For a thorough discussion of the notion of sustained yield, see Parry, Vaux, and Dennis, *supra* note 7, at 150-154.

14. R. HEILBRONER, *THE MAKING OF AN ECONOMIC SOCIETY* 183-191 (1972).

15. See generally C. CHURCHMAN, *THE SYSTEMS APPROACH* (1979); J. VON NEUMANN AND O. MORGENSTERN, *THEORY OF GAMES AND ECONOMIC BEHAVIOR* 11 (1947).

livestock), but also outputs not usually priced on the open market such as water yield, sediment (a negative output), fish, big-game animals, developed and undeveloped recreation opportunities, and so on. To the extent possible, these outputs were priced using "willingness-to-pay" values,¹⁶ dubbed by some Forest Service analysts as "funny money numbers." And, although some economists, including John Duffield,¹⁷ have made recent progress in determining these values, many professionals still regard them as conceptually suspect.¹⁸

When "willingness-to-pay" values could not adequately price certain forest outputs, the optimization-modelling approach incorporated them in the form of constraints on the optimal solution. Thus, for example, the Lolo National Forest Plan forced FORPLAN to allocate 225,000 acres to big-game winter range.¹⁹ The nature of such a constraint is to make the acres allocated infinitely valuable up to the level of the constraint, and of no value at all beyond that critical level. Besides placing a heavy burden on personnel to correctly identify the exact level of the constraint, this represents a very crude approach to delineating diminishing marginal returns.

The adoption of this deterministic, analysis technique raised another formidable problem by requiring the agency to identify many important input-output relationships (coefficients), and particularly the interrelationships between resources. Currently, forest science techniques are incapable of stating many of these relationships in a reliable quantitative manner. For example, although much is known about the interaction between timber harvesting and elk movement, or between road-building and soil erosion, the agency cannot reliably convert this knowledge into

16. Examples for willingness-to-pay values for recreation are found in U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, LOLO NATIONAL FOREST PLAN FINAL ENVIRONMENTAL IMPACT STATEMENT B-28 (1986) [hereinafter LOLO FEIS]. For a general discussion of the concept, see Krutilla, Bowes and Wilman, *National Forest System Planning and Management: An Analytical Review and Suggested Approach* in GOVERNMENTAL INTERVENTIONS, SOCIAL NEEDS, AND THE MANAGEMENT OF U.S. FORESTS 223 (R. Sedjo ed. 1983).

17. See generally Duffield, *RPA Values For Recreation: Theory and Practice*, in this volume.

18. Historically, the Forest Service has not been known to take its own assessment of these "willingness-to-pay" values very seriously. For example, in preparing the 1980 RPA assessment for this region (Region 1), I found that agency figures indicated that the gross value of water production exceeded the gross value of all other benefits combined by over 300 percent. And, in the alternative most favorable to timber production (alternative 2), the net benefits from recreation, wilderness and wildlife together exceeded the benefits of timber management by over 200 percent. A. McQuillan, Report Of Economic Analysis Of Forest Service Region 1 — 1980 Draft RPA Data 19 (July 1979) (unpublished paper available from U.S.D.A. Forest Service, Northern Region, Missoula, MT). These findings were not used to re-evaluate the relative emphasis that was to be placed on the various agency programs, traditionally dominated by timber management. For a discussion of timber dominance, see generally D. CIARY, *TIMBER AND THE FOREST SERVICE* 252 (1986).

19. LOLO FEIS, *supra* note 16, at Appendix B, 31-32, 72-73.

simple coefficients in terms of elk per acre-logged, or tons of sediment per mile of road construction for input to FORPLAN. Yet, consideration of factors such as these is crucial in the task of forest planning.

Besides the problems associated with measurement, certain logical problems also arise. For example, when an NPV-maximizing objective function is coupled with constraints designed to ensure nondeclining even-flow (NDEF), violations of NFMA inevitably result under certain common conditions. Unless forest planners restrain FORPLAN from considering prescriptions with negative objective-function coefficients (which they do not), the periodic planning process²⁰ can actually produce declining levels of harvest over time, violating section 11 of NFMA, despite (and in fact because of) the inclusion of NDEF constraints in FORPLAN.²¹ This logical non-sequitur occurs because not all of the implications of this constrained-maximization approach were thought through prior to its adoption.

Distinct from the problem of finding the maximum NPV under certain constraints, the adoption of a linear programming model (FORPLAN) raised other serious deficiencies in the planning methodology. LP requires the adoption of certain restrictive assumptions including proportionality, additivity, divisibility, and certainty. These assumptions raise certain well-documented problems such as the inability to model diminishing marginal returns, returns to scale, fixed costs and other economic realities.²² In addition, LP is an inherently inefficient architecture when solving the huge matrices involved in the planning of a complex national forest. Even a comparatively simple forest planning problem produces huge matrices which require a mainframe computer and a large amount of CPU time and cost to solve. These requirements frequently restrict the planners' ability to represent their forest with a sufficient degree of resolution in the FORPLAN model.

For example, the Lolo National Forest planners originally stratified the land into three slope classes. They placed breaks at 35% slope (above which logging becomes considerably more expensive) and at 60% slope (above which certain environmental problems with logging arise). The planners found that this scheme resulted in more land strata than FORPLAN could accommodate, so they subsequently combined all slope classes below 60%, reducing the number of analysis areas to 220, a number which met the size limitations of the model. Because they averaged logging costs for land above and below 35% slope, important resolution was lost.

20. NFMA requires periodic forest planning at least every 15 years. 16 U.S.C. § 1604(f) (1982).

21. McQuillan, *The Declining Even Flow Effect — Non Sequitur Of National Forest Planning*, 32(4) FOREST SCIENCE 960 (Dec. 1986).

22. F. HILLIER AND G. LIEBERMAN, *INTRODUCTION TO OPERATIONS RESEARCH* 24-26 (1980).

Thus, the model might incorrectly eliminate gently-sloping land from logging because costs were shown to be too high, or incorrectly allocate steeper lands to logging because costs were not shown to be high enough.²³

Another problem is that FORPLAN cannot adequately handle spatial relationships. Most people have little difficulty imagining forest lands as river drainages or watersheds with a complex interrelationship between adjacent stands of trees. Game animals move between ridge tops and creek bottoms; soil erosion, like water, flows from upslope to downslope; certain areas can be seen from the highway and others are obscured by topography; if a certain area is logged, then adjacent timber needs to be left standing to provide for reseeding, and so on. However, the spatial nature of these relationships shields them from the vision of FORPLAN. In a roadless drainage, timber stands cannot be scheduled for logging unless roads can be built for log hauling. However, if the forest plan allocates a critical entry point to the drainage to remain in roadless condition, then road building cannot proceed anywhere. This logic escapes FORPLAN. Furthermore, expensive roads usually serve more than one timber harvesting operation, with subsequent harvests often spread over several decades. But, if the first scheduled harvest lies at the head of the drainage and requires that the entire road be built immediately, then FORPLAN cannot realistically represent road construction costs in relation to the amount of timber harvested (computed as dollars/acre harvested). All of these factors require a spatially-specific solution. Thus, a model which is incapable of spatial specificity has serious shortcomings.

The nature of linear programming is such that achieving spatial resolution is very difficult. FORPLAN was modified to allow some degree of spatial resolution (called aggregate area emphasis), but it results in a larger matrix, which exacerbates the computer-space limitation problems already discussed. Consequently, this feature is seldom used. Other LP-related approaches to this problem usually involve the use of integer programming²⁴ (IP), but the architecture of IP is inherently even less efficient than LP. The greatest hope for solving this modelling problem lies with the development of graph theory-based models,²⁵ a task not yet

23. See Lolo FEIS, *supra* note 16, at III-2, B-11. The problem was first raised in a Response to the Draft Forest Plan by the Inland Forest Resource Council, Missoula, Montana on September 26, 1980. *Id.* at Appendix 22.

24. M. Kirby, *Mixed-Integer Models For Integrated Planning*, in *1985 Symposium On Systems Analysis In Forest Resources* 315-323 (1987) (available from Georgia Center For Continuing Education, Athens, GA).

25. See Jackson, *Economic Suitability of Lands For Timber Production: A Proposed Rule of Reason* in this volume; A. McQuillan, *Economic Valuation Of Timber Potential For Undeveloped Forest Land Using A Modified Dynamic Programming Algorithm* 127-144 (1985) (Stoors International AMSE Conference, Stoors, CT).

approached by the Forest Service.

Pressed by time and the need to start the planning required by the 1976 Act, the agency directed the nationwide implementation of FORPLAN in the late 1970s without much experimental testing. Besides the promised analytical advantages of an optimization model, the agency also recognized the organizational advantages of the FORPLAN model in bringing consistency to a national planning effort that had traditionally involved the supervisors of 191 million acres of public forest land in 156 national forests making decentralized decisions.

This rush to adopt such a sophisticated planning model brought with it other problems. Successful implementation would have required the presence of a competent linear programming expert on each and every national forest. Although some forests had such experts, many planning teams were simply devoid of a linear programmer with sufficient expertise to not only use the model, but also to understand model behavior and teach others to understand it, so that intelligent interactive planning could ensue. The Forest Service rightly composed the interdisciplinary planning teams of wildlife biologists, hydrologists, soil scientists, timber planners, recreation managers and other people, but these specialists generally had little or no knowledge of linear programming or the restrictive assumptions attending its use. These problems of personnel and education were not and could not have been overcome simply by sending the planning team members to a few days of short courses on FORPLAN modelling. As a result, the individuals responsible for plan preparation, although generally competent and well-trained professionals, were forced to use a planning technology that was generally beyond their comprehension.

This situation was described by the designer of FORPLAN himself, Dr. K. Norman Johnson, who said:

[W]e have developed a forest planning process that may go beyond the average planning teams' ability to implement Although we tried to write FORPLAN so it would be understandable to potential users, we may have misjudged our clients. We probably wrote it for the most analytically sophisticated of the planning teams, rather than the average. This orientation, combined with the mobility of Forest Service employees, has meant that the average planning team may feel befuddled by FORPLAN Travelling to the National Forests around Oregon and around the country, it is discouraging to see how little time is spent understanding why particular FORPLAN results are being found on each forest.²⁶

26. K. Johnson, *Reflections on the Development of FORPLAN*, in U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, *FORPLAN: AN EVALUATION OF A FOREST PLANNING TOOL*, GENERAL TECHNICAL

The agency's decision to implement FORPLAN resulted in a considerably more mechanistic approach to forest planning than that required by NFMA. In adopting this hyper-mechanistic approach to forest planning, the agency forced itself to do the impossible and, in the process, failed to bring about the "rule of reason" that the Committee of Scientists deemed to be the Congressional intent of NFMA.²⁷ By choosing a linear programming model (FORPLAN) which uses a constrained optimization technique to find the maximum NPV, the agency's forest economists indeed "promised more than they could deliver."

III. ECONOMIC ANALYSIS AND AGENCY REGULATIONS

Although the problems associated with the economic analysis functions of FORPLAN are considerable, they do not represent the only or the most significant problems with the use of economic analysis in national forest planning. Fundamental problems with economic analysis arise in the way in which the Forest Service implemented NFMA with federal regulations, and, particularly, with the way in which lands unsuitable for timber management are determined.²⁸

These regulations are designed to implement section 6(k) of NFMA which states:

In developing land management plans pursuant to this Act, the Secretary shall identify lands . . . not suited for timber production, considering physical, economic, and other pertinent factors . . . , and shall assure that . . . no timber harvesting shall occur on such lands for a period of 10 years²⁹

In part, these regulations also implement section 6(g)(3)(e) of the Act which states:

[This provision will] insure that timber will be harvested from National Forest System lands only where;
(i) soil, slope, or other watershed conditions will not be irreversibly damaged;
(ii) there is assurance that such lands can be adequately restocked within five years after harvest;³⁰

REPORT RM-140 45-51 (April 1987). For a further discussion of these issues, see *infra* Section V.

27. For an explanation of what the Committee of Scientists called a "rule of reason," see Teeguarden, *Benefit-Cost Analysis in National Forest System Planning: Policy, Uses, and Limitations*, 17 ENVTL. L. 393, 395 (1987).

28. 36 C.F.R. § 219.14(a), (b) and (c) (1988).

29. 16 U.S.C. § 1604(k) (1982).

30. 16 U.S.C. § 1604(g)(3)(E)(i), (ii) (1982). The five-year restocking provision originated in an official Forest Service report in 1971. U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, NATIONAL FOREST MANAGEMENT IN A QUALITY ENVIRONMENT: TIMBER PRODUCTIVITY I-II (1971). According to Wilkinson and Anderson, the report "suggested that land be withdrawn from timber production where

Congress enacted this language to address the widely-shared views of the Church Public Lands Subcommittee of the Senate which, in 1972, concluded that certain Forest Service lands had been logged "*which should not have been subjected to any activity related to timber harvesting. . . . These were areas of special scenic values, fragile soils, or other limiting physiographic conditions, areas where adequate regeneration could not be assured, and areas where the costs of special measures to avoid environmental damage or assure regeneration were so high that the activity was imprudent and relatively uneconomic.*"³¹

Much has been written about section 6 of NFMA, which incorporates this Congressional intent, since the language does not clearly stipulate what kind of economic analysis is required, or the extent to which the analysis should be used in the determination of lands unsuitable for timber harvesting. Dr. Dennis Teeguarden, a member of the Committee of Scientists (COS) which drafted the regulations, concluded, "[I]t is fairly clear that the conferees [COS] did not want the Secretary to harvest timber on lands where *by some rule of reason* public benefits were less than production costs."³² As Professor Charles Wilkinson commented, "These carefully chosen words should be taken to heart."³³

The Forest Service adopted a three-step screening process to approach the timber suitability question. In subsection (a), the agency screens all forest lands for overriding administrative or legal restrictions that would preclude timber harvesting (such as prior designation under the Wilderness Act), and for physical and biological limitations related to the propensity for soil or watershed damage, or the inability to assure adequate forest regeneration within five years following logging.³⁴ The Forest Service refers to this as stage 1 of the suitability test. With regard to soil or watershed damage, the regulation states that lands shall be identified as not suited for timber production where "technology is not available to ensure timber production from the land without irreversible resource damage to soils productivity, or watershed conditions."³⁵ Thus, Congress intended NFMA to stop timber cutting where it was likely to result in severe ecological damage. By phrasing the regulation narrowly in terms of

reforestation could not be assured within five years after logging." Wilkinson and Anderson, *supra* note 4, at 140-141.

31. "Clearcutting" Practices on National Timberlands: Hearings before the Subcomm. on Public Lands of the Senate Comm. on Interior and Insular Affairs, 92d Cong., 1st Sess. 6 (1972) (emphasis added).

32. Teeguarden, *supra* note 27, at 403-4 (emphasis altered).

33. Wilkinson and Anderson, *Below-Cost Sales — Are They Legal?*, 85 J. FORESTRY 21, 25 (Aug. 1987).

34. 36 C.F.R. § 219.14(a) (1988).

35. *Id.* at § 219.14(a)(2).

technology, the Forest Service effectively circumvented this part of the screening process. For example, in 1975, the Timber Management Plan for the Rio Grande National Forest withdrew from harvesting 6,000 acres of land because of unstable soils. In the final NFMA Plan, the agency withdrew no lands for this reason.³⁶ Despite a history of landslides during the intervening ten years, the agency defended its omission on the basis of the wording in the regulations:

[Plaintiff's] suggestion that the deletion of 6,000 acres in a 1975 Timber Management Plan because of "unstable soils" requires that the Plan make similar deletions ignores the fact that the test of the regulations, adopted in 1979, is different, *focusing as it does on the availability of technology* The result was that the stratification "unstable soils" was not used in the Planning process.³⁷

Similarly, the agency relied on the availability of technology rather than on operational feasibility with regard to regeneration. The third part of subsection (a) states that lands shall be identified as not suited for timber production where "there is not reasonable assurance that such lands can be adequately restocked as provided in § 219.27(c)(3)."³⁸ And the referenced subsection states:

[timber] cuttings shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands within 5 years after final harvest.³⁹

In responding to appeals of forest plans, the Forest Service has argued that statistical studies of past regeneration performance are not particularly relevant since the emphasis of the regulation is on the existence of technology and knowledge rather than on proven accomplishments.⁴⁰ In response to an appeal of the Beaverhead Forest Plan on this issue, the Regional Forester stated, "Research, in this case is considered to be findings published in referred journals and papers."⁴¹ Most forests in Region 1 excluded very few lands on the basis of regeneration difficulty,

36. U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, RIO GRANDE NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN AND FINAL ENVIRONMENTAL IMPACT STATEMENT (1985).

37. Defendant's Memorandum in Response to Plaintiff's and Intervenor's Briefs at 6 n. 5, *Citizens for Environmental Quality v. United States*, No. 87-F-1714. (E.D. Tex. Dec. 12, 1988) (emphasis added).

38. 36 C.F.R. § 219.14(a)(3) (1988).

39. 36 C.F.R. § 219.27(c)(3).

40. Defendant's Memorandum in Response to Plaintiff's and Intervenor's Briefs, *supra* note 37, at 5-6.

41. Regional Forester's Responsive Statement to the National Wildlife Federation Appeal of the Beaverhead National Forest Land Management Plan (Sept. 28, 1987).

despite the fact that regeneration tardiness had been a major concern here and elsewhere prior to passage of NFMA. Wilkinson and Anderson reported, "A 1974 Forest Service report, for instance, revealed that only one-third of the cutover land in the Rocky Mountain national forests was successfully regenerating."⁴²

The Forest Service Manual reflects this move to de-emphasize the rigor of the regeneration screening process:

All the [reforestation] problems encountered are solvable. . . . In general, if sites meet the criteria for timber, soil, and water productivity for soil and water protection, and are harvestable with current logging equipment, then there is seldom any reason to preclude them from management due to reforestation problems.⁴³

If the Israelis can grow grapes in the desert, the logic seems to hold, then foresters can regenerate trees in the Rocky Mountains. However, the availability of technology is a necessary but not sufficient condition for successful, prompt reforestation. It must also be applied in fact, and it must be applied successfully, sometimes with repeated operations such as replanting trees after the first or second attempts have failed. And one must ask, at what cost?

The Church Subcommittee, quoted above, did not want the agency to harvest timber where the costs of regeneration were imprudent, and an earlier draft of NFMA had proposed logging only on lands "which, within five years after timber harvest, will regenerate the growth of trees naturally or with a *modest reforestation investment*."⁴⁴ Although Congress omitted this specific language from the statute, the call for prudence is clear. At the very least, prudence would require not only that technology for prompt regeneration exists, but also that the agency successfully employ it. Furthermore, prudence would require an economic test taking into account the probability of success of the technology and the most likely final, total cost of the regeneration effort. Forest Service Chief McGuire's testimony confirms this interpretation. He stated, "[W]e do not intend to manage the [economically] submarginal lands for timber production, but, on the other hand, we may want to do some timber harvesting for wildlife, water,

42. Wilkinson and Anderson, *supra* note 4, at 154 (reviewing U.S. DEP'T OF AGRIC., U.S. FOREST SERVICE, THE ROCKY MOUNTAIN TIMBER SITUATION 1970 25-26 (Research Bulletin INT-10 (1974))).

43. FOREST SERVICE HANDBOOK § 2409.26(B) R-1 (1988).

44. *Comm. on Agriculture and Forestry and Comm. on Interior and Insular Affairs, Comparison of S. 3091, as Amended, With Proposed Amendments By Sen. Metcalf* § 3(d)(5)(C)(v), 94th Cong., 2d Sess. (1976) (emphasis added), cited in Wilkinson and Anderson, *supra* note 4, at 156 n. 807.

or other reasons.”⁴⁵

The statute requires the Forest Service to declare unsuitable for timber harvesting all lands where regeneration cannot be assured within five years following logging. The regulations implementing this section do not appear to provide the rigorous screening process necessary to provide this assurance.⁴⁶ As a result, this stage of the suitability test withdraws very few of the tentatively suitable timberlands.

Having supposedly screened for administrative and ecological impediments to timber suitability in section 219.14 (a), subsection (b) directs the analysis of site-specific economic efficiency. This regulation clearly stipulates:

[Lands tentatively suitable for timber production] shall be further reviewed and assessed prior to formulation of alternatives This analysis shall identify the management intensity for timber production for each category of land which results in the *largest excess* of discounted benefits less discounted costs Direct benefits are expressed as *expected gross receipts to the government*.⁴⁷

With this analysis, the Forest Service intended to ensure some attempt at identifying efficient timber management prescriptions before they are entered into the FORPLAN model. Absent such attempts, there is a risk that FORPLAN might find timberlands to be unsuitable which are, in fact, quite efficient for timber production on a site-specific basis. The FORPLAN model can only accommodate a limited number of prescriptions, and without pre-screening and careful selection, there is a good chance that, in all of its options, the direct costs of timber production will exceed the direct benefits.

The need for this analysis is reduced if FORPLAN is allowed to assign any and all tentatively suitable lands to the suitable timber base regardless of site-specific economic efficiency. This explains why the agency stated

45. *Senate Comm. on Agriculture and Forestry and Senate Comm. on Interior and Insular Affairs, Transcript of Proceedings, S. 3091 As Amended* 114 (May 4 1976) (emphasis added) cited in Wilkinson and Anderson, *supra* note 4, at 165 n. 845.

46. 36 C.F.R. §§ 219.14(a) and 219.27(c)(3) (1988). Another serious deficiency in the regulations lies in the definition of when the five-year clock is set to begin running. For example, 36 C.F.R. § 219.27(c)(3) states, “Five years after final harvest means . . . 5 years after the seed tree removal cut in seed tree cutting” As any forestry student should know, regeneration in a seed tree cut is expected to occur following the initial logging when the seed trees were left to provide a source of seed. If regeneration did not occur at this time, foresters would consider the attempt a failure. As the regulation is written, a failure would not occur unless regeneration had not been achieved by 5 years after the final removal of the seed trees. And, of course, this event could be postponed indefinitely by simply never removing the few seed trees left on the site. This interpretation of NFMA is ludicrous and has the effect of creating a loophole in the law.

47. 36 C.F.R. § 219.14(b) (emphasis added).

that this "second stage requires *merely* the evaluation of the potential economic efficiency of the tentatively suitable land."⁴⁸

Subsection (b) requires only that the Forest Service carry out the analysis. It provides no screening process for removal of land from the suitable timber base on grounds of its intrinsic economic efficiency, or lack thereof, for timber production.⁴⁹ Because this subsection does not provide an economic screening process, it appears to circumvent the intent of NFMA with regard to the delineation of submarginal lands.

The history of NFMA clearly shows that Congress did not intend to guide timber management decision making solely with strict economic criteria.⁵⁰ However, it is equally clear that Congress intended economic efficiency to form an important part of the "rule of reason" recognized by the Committee of Scientists (COS). As COS member Teeguarden wrote:

[The] COS took issue with the view that economic efficiency was the sole criterion for decision making, stating that "congressional direction of this sort is evident *only in one area, that is, the determination of lands suitable for timber production . . .*"⁵¹

According to Wilkinson and Anderson, "[T]he Committee's [COS] intent was to compel planners to apply the analysis required by 36 C.F.R. § 219.14(b) in order to *identify* economically unsuitable lands."⁵²

Gorte and Baldwin of the Congressional Research Service affirmed this view:

Congress rejected the Senate language that based the determination [of suitable timber lands] solely on an economic analysis of the direct costs and returns from projected timber production; rather the Secretary was instructed to consider physical factors of the lands in question, economics, and "other pertinent factors to the extent feasible." The legislative history strongly suggests that the language was expanded to provide greater flexibility to the Secretary in making the determinations, in view of the fact that forest lands and conditions are so varied nationwide . . .⁵³

48. Defendant's Memorandum in Response to Plaintiff's and Intervenor's Briefs, *supra* note 37, at 16 (emphasis added).

49. Defendant's Memorandum states that tentatively suitable lands do not get eliminated at this stage (2) since "the regulations do not require the deletion of analysis areas disclosed by the stage II analysis to have negative net worth for timber production." *Id.* On the Rio Grande National Forest, 37 of the 40 analysis areas had a negative net worth for timber production. See RIO GRANDE FINAL ENVIRONMENTAL IMPACT STATEMENT, *supra* note 36.

50. See generally Wilkinson and Anderson *supra* note 4; also Teeguarden, *supra* note 27.

51. Teeguarden, *supra* note 27, at 405 (citing *Final Report of the Committee of Scientists*, 44 Fed. Reg 26,599, 26,635 (1979)).

52. Wilkinson and Anderson, *supra* note 4, at 194 (emphasis added).

53. R. Gorte and P. Baldwin, The Timberlands Suitability Provision of the National Forest Management Act of 1976 39 (April 11, 1986) (available from Congressional Research Service, The

However, it appears that physical factors (*related to the intrinsic characteristics of the lands themselves*) and the profitability of timber investments were intended to be the basic considerations in identifying lands suited for timber production. . . . [I]t also appears that Congress intended the resource evaluations, *including* the timberland suitability determination, to be conducted *before* formulating and evaluating alternatives.⁵⁴

In fact, the regulations do not require the determination of economic suitability at this second stage (governed by 36 C.F.R. § 219.14(b)), instead they leave it until the third stage, after formulation of the plan alternatives and during their evaluation. Subsections (a) and (b), when taken together, screen out very little land as unsuitable for timber management on the basis of its intrinsic characteristics and postpone almost the entire suitability question until the third and last stage of the suitability determination.

The regulation that guides the third stage states, in part, "Lands shall be tentatively identified as not appropriate for timber production . . . if . . . (3) *The lands are not cost-efficient*, over the planning horizon, in meeting forest objectives, which include timber production."⁵⁵ The Forest Service has explained, "As can be seen, the regulations specifically include timber production goals as a relevant factor in determining which lands are suitable for timber production."⁵⁶

In allowing predetermined output goals to drive the timberland suitability process, forest planners are violating the Congressional intent of NFMA with regard to the suitability question. If the agency sets timber or other closely related production goals sufficiently high at the outset, then they will force *any and all* tentatively suitable timberlands into the timber base, no matter how patently unsuitable for timber production (or more valuable for other, non-timber uses) they may be on a case by case basis. As Wilkinson and Anderson stated:

A legislative history of the NFMA indicates that Congress intended harvest levels to be determined by local plans—from the bottom up rather than from the top down.⁵⁷

Under direction of Forest Service regulations, however, harvest levels are driven by national or regional output goals from the top rather than by site-specific conditions from the bottom.

Library of Congress) (citing *Final Report of the Committee of Scientists*, 44 Fed. Reg. 26,599 (1979)).

54. *Id.* at 41 (emphasis added and emphasis in the original).

55. 36 C.F.R. § 219.14(c) (1988) (emphasis added).

56. Regional Forester's Responsive Statement, *supra* note 41, at 17.

57. Wilkinson and Anderson, *supra* note 4, at 90.

By effectively eliminating the impact of the site-specific suitability screens at stages I and II and by allowing the suitable timberlands to be defined in relation to the need to meet targeted outputs during stage III, the agency has grossly distorted the entire thrust of the NFMA with regard to suitability. A remark made by Gorte and Baldwin of the Congressional Research Service might explain one underlying reason for this distortion, "Changing the current regulations to require a revenue-cost comparison before forming alternatives *could drastically alter the acreage* of timberland identified as suited for timber production in the national forest plans"⁵⁸

Determining, in major part, the economic suitability of timberland relative to a prior determined timber production goal as permitted by section 219.14 is clearly incongruous with the intent of section 6(k) of NFMA. The Congressional Research Service authors support this conclusion:

Because the current regulations do not appear to require the kind of economic analysis Congress envisioned, and because the regulations appear to result in a comparative evaluation of the ability of lands to meet timber output targets, rather than of their basic ability to sustain profitable commercial timber investments, *a court might well conclude that the current regulations do not carry out the intent of Congress as to the separate timberland evaluation of section 6(k).*⁵⁹

IV. RESTORATION OF THE PUBLIC TRUST

Can one conclude, therefore, that the problems with economic analysis in FORPLAN and the problems with the economic suitability determination as codified in the Federal Regulations together jeopardize the success of Forest Service planning under NFMA? Perhaps. But, the planning process as designed and implemented contains a more fundamental problem.

Clearly, Congress enacted the National Forest Management Act essentially as a response to a failure of trust on the part of the public with respect to the practices of the Forest Service.⁶⁰ This loss of faith in

58. Gorte and Baldwin, *supra* note 53, at 44 (emphasis added).

59. *Id.* (emphasis added).

60. Churchman pointed out the vast difference that often lies between the stated and the true objectives of a complex system. He has also shown how part of the job of the management scientist or planner is to sort out the system's true objectives and respond to them in designing its methodology of planning. Churchman, *supra* note 15. The true objective of planning under NFMA was undoubtedly to restore the public trust in Forest Service land management. However, Felsen pointed out how there is no objective way to design an objective planning system. J. FELSEN, *DECISION MAKING UNDER UNCERTAINTY: AN ARTIFICIAL INTELLIGENCE APPROACH* (1976). Planning systems should be

professional expertise, and consequent collapse of trust, grew out of the narrow timber management focus of the agency prior to the 1970s.⁶¹ The public landowners of the national forests perceived an insensitivity by agency foresters to the needs and desires of the people. These needs and desires related principally to the protection of aesthetic values in the forest. They also related substantially to environmental concerns and to the need for some "rule of reason" with regard to the expenditure of public funds.

The need for sensitivity with regard to aesthetics was clearly expressed by Senate bill co-sponsor Humphrey, who declared:

The days have ended when the forest may be viewed only as trees and trees viewed only as timber. The soil and the water, the grasses and the shrubs, the fish and the wildlife, and the beauty that is the forest must become integral parts of resource manager's thinking and actions.⁶²

Attempts to force sensitivity to aesthetic, environmental and economic concerns on the Forest Service led to significant disruptions in the management of national forests in the early 1970s, the most famous of which were the Bitterroot controversy⁶³ and the Monongahela decision of 1973, upheld by the Fourth Circuit Court of Appeals in 1975.⁶⁴

In response to these disruptions, Congress enacted the National Forest Management Act to bring about the sensitivity and the rule of reason demanded by the public. Thus, much of the language of the Act addresses the substantive issues of timber harvesting, planning, economic

designed thoughtfully and insightfully to respond to the essential needs of the clientele, and a crucial first step in this process must be the identification of the true nature of the client's problem. Therefore, with NFMA, the first job for the Forest Service was to design a planning scheme that could effectively restore the public trust.

61. See generally D. CLARY, *supra* note 18, at 252; also Wilkinson and Anderson, *supra* note 4, at 371.

62. 122 CONG. REC. 5618-19 (1976), *quoted in* Wilkinson and Anderson, *supra* note 4, at 70. Similar views were expressed by Acting Chairman of the House Subcommittee on Forests Melcher, who stated that the House bill "directs that the Forest Service must protect watersheds, . . . must protect streams, must protect wildlife habitat, and must preserve aesthetic values in planning all of the timber sales in any of the units of the national forest." 122 CONG. REC. 30,525 (1976), *quoted in* Wilkinson and Anderson, *supra* note 4, at 75. The consideration of aesthetic values has been only scantily addressed in the regulations and in the plans, and yet it remains a root cause of much current public concern.

63. Senator Lee Metcalf requested a report from the Select Committee of the University of Montana in 1970 on Forest Service practices in the Bitterroot National Forest. The Select Committee presented its findings to Congress in a report entitled *A University View of the Forest Service*, also known as the Bolle Report. S. Doc. 115, 91st Cong., 2d Sess. (1970). Compare Bolle, *The Bitterroot Revisited: A University Re-View of the Forest Service* in this volume.

64. West Virginia Div. of the Izaak Walton League of America, Inc. v. Butz, 522 F.2d 945, (4th Cir. 1975), *aff'g* 367 F. Supp. 422 (N.D. W.Va. 1973). See, e.g., Wilkinson and Anderson, *supra* note 4, at 41; Wilkinson and Anderson, *Below-Cost Sales — Are They Legal?*, 85 J. FORESTRY 21 (March 1987).

analysis and environmental protection. It is understandable that agency planners perceived the Act to be a call for adoption of a planning system designed to achieve efficient maximization of net public benefits,⁶⁵ since this is consistent with a utilitarian approach to multiple-use management. However, one must recognize that, in the first instance, Congress designed NFMA to bring about a restoration of public faith and trust in Forest Service management.

V. CONCLUSION

As the mechanism for a restoration of trust, Congress had previously provided for public involvement through the National Environmental Policy Act,⁶⁶ and as the vehicle, Congress established the forest planning process. By the sensitive application of rules of reason exposed to public scrutiny, Congress hoped that the agency would demonstrate the reasonableness of its management decisions to a skeptical public and, consequently, restore public trust in the management professionals. This was the true intent of NFMA. To ensure the success of forest planning, the public would have to have access to the planning process, would have to be able to understand the planning process and would have to perceive that there were no attempts to cloud the planning process in a veil of deception or secrecy. In order to meet these conditions, it was attendant upon those who designed the planning process to insure that it was transparent, readily comprehensible, and open to public review.

It appears that the designers of the forest planning process never recognized this need. Instead, they perceived an overriding need to determine the optimal, socially efficient forest plan. To accomplish this, they adopted a sophisticated "black box" model (FORPLAN) which is not only inaccessible to many of the agency's own professionals, but also beyond the general reach and scrutiny of an intelligent lay public. The inventor of the FORPLAN model, Johnson, made this same point:

The disadvantage [of the planning model] is that no one besides the "analyst" may know how they are representing their forest planning problems in FORPLAN. Thus, the Forest Supervisor and the Forest Planner who often have to meet with the public to discuss FORPLAN results, may have no clear idea about the forest plan model that is producing the results they are trying to defend . . . FORPLAN remains a mystery because it represents forest planning problems in ways that run counter to how

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

66. 42 U.S.C. §§ 4321, 4331-4335, 4341-4347 (1982).

people think about these problems.⁶⁷

Anyone who has tried to unravel the mysteries of a particular forest plan is familiar with the problem.

Teeguarden also recognized these issues related to the public review of forest plans:

Also troublesome is that the size and complexity of the model required to represent the planning problem may make it impossible for external reviewers to identify and track the effect of rules for constraint construction on results.⁶⁸

In the end, we have in place a planning system which, by its very complexity and opacity, is likely to fail in the mission for which it was intended, the restoration of public trust in the management of national forest lands by United States Forest Service professionals. The outcome, thus far, has been the myriad appeals filed on forest plans throughout the nation. The inevitable litigation is just beginning.

This litigation is not necessarily unwelcome. As with NEPA, case history will establish the intent of Congress and give meaning to crucial words and phrases in the Act. However, the complexity of the planning process adopted in response to NFMA seems to inhibit the ability of the judicial system to review alleged violations of the Act. Attorneys who are unfamiliar with the National Forest Management Act have a hard time understanding its complex provisions and an even harder time understanding the adopted planning process. Consequently, they tend to fall back on NEPA-related issues with which courts are more familiar and ignore substantive provisions of NFMA. In many cases, this is necessary because the courts cannot comprehend the intricacies of the forest planning process.

The inaccessibility of NFMA raises serious doubts about its prospects for success. If the Act cannot be effectively litigated, then neither the public nor the courts have access to the planning process designed to comply with the Act. It follows that the Act will not likely restore any reasonableness and trust in the management of national forest lands. And thus, we are no further ahead than we were in the mid-1970s prior to the passage of NFMA.

67. Johnson, *supra* note 26, at 48.

68. Teeguarden, *supra* note 27, at 422-23.