Federalism and Natural Resource Management: Comparing State and National Management of Public Forests

by

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Abstract

The question of appropriate jurisdictions for various government activities is a fundamental issue in American politics and policy. In the realm of natural resource policy, initiatives to transfer certain responsibilities between the national and the local or state level are often debated. This paper compares state and national policy in the context of public forest management. Data for this part of the study come from two cases, each comprising two forests sharing similar physical characteristics but governed by different levels of government. Systematic comparisons suggest several important differences between Federal and state policies and outcomes. Officials in the national agency (the U.S. Forest Service) face greater statutory, regulatory, and planning constraints affecting their activities than do state forestry agency officials. These constraints require more public input and higher levels of environmental protection. Outcomes reflect these differences: national officials provide less timber, at higher expense, than do state officials. Concurrently, national officials undertake greater efforts to provide non-timber environmental benefits than do state forestry officials.

Introduction

The question of appropriate jurisdictions for various government activities is a fundamental issue in American politics. There is, periodically, much debate regarding initiatives to transfer certain programs from the national to the local or state level. For example, President Nixon's "New Federalism" aimed to provide local government with more freedom to carry out social programs. A few years later, western proponents of the "Sagebrush Rebellion" called for the transfer of land and other natural resources from national to state control. More recently, the 104th Congress has generated proposals to devolve a number of programs to the state level. During these debates over appropriate levels of governance, proponents of state primacy claim that states would provide more effective and efficient administration, while opponents counter that national control is necessary for achieving certain policy goals. Natural resource policy is one important area likely to be affected by jurisdictional changes.

Existing Knowledge Relevant to the Research

Amid proposals to centralize or devolve authority for various programs to higher or lower levels of government, it is important to develop a systematic, thorough understanding of differences that may exist between levels. Such an understanding is informed by a number of research traditions, including higher versus lower levels of government responsibility, factors influencing policy processes, and outcomes. Previous studies in these areas suggest hypotheses to be tested empirically in this study.

Higher- Versus Lower-Level Government Control

A number of scholars have sought to describe functional differences across governmental levels. Peterson (1995) suggests two distinct policy types, developmental and redistributive. In Peterson's

functional model, lower levels of government favor developmental policies over redistributive ones, because these jurisdictions focus on economic goals. Redistribution, on the other hand, drives wealthier individuals and firms away, hurting the tax base. Therefore there is little support for redistributive policies at lower levels of government. Peterson et al. (1986) support this argument with their analysis, concluding that in cases of national programs implemented at the local level, cities are more willing to pursue policies that encourage economic development.

Regarding natural resource policy specifically, researchers have described substantial differences between state and national levels. Lower levels of government are expected to encourage industrial activities that favor economic development over environmental protection. For example, Moe (1989) argues that, in the face of interjurisdictional competition for industry, lower-level governments set less stringent environmental standards than does the Federal government. During the Sagebrush Rebellion in the early 1980s, western ranchers, timber producers, and others favoring commodity uses from public lands called for devolution of Federal lands to the states, believing that state control would result in fewer environmental regulations and greater commodity development (Short 1989).

Factors Influencing Policy Processes

A second major strand of research relevant to this study is the literature focusing on bureaucratic decision making in forest agencies, particularly the United States Forest Service (USFS). Attempts to explain public forest policy processes in the U.S. have emphasized three primary factors as shaping bureaucratic decisions: agency officials' values, incentives and constraints they face, and interactions with non-agency participants seeking influence. This study examines the importance of these factors in influencing policy processes.

Past studies of the values of forest agency officials have focused on Federal personnel, frequently portraying USFS officials as holding narrowly timber-oriented beliefs (Kaufman 1960, Twight and Lyden 1988, O'Toole 1988). More recently, however, studies of USFS employees' values and behavior indicate less of a timber focus, with more emphasis on environmental and recreational interests (Tipple and Wellman 1991, Boyle 1994, Brown and Harris 1992, Cramer et al. 1993). Little work has been undertaken to understand employees in various state forest agencies, to test the long-standing view that better-educated, more able individuals interested in public service are attracted to national rather than state government, because of better pay and civil service protection (White 1953, 63). More recently, state employees have exhibited increased professionalization and capacity to meet policy challenges (Cigler 1993, Bowman and Kearney 1986, Eisinger 1988). Furthermore, a common disciplinary background (forestry) and professional organizations like the Society of American Foresters may serve to link individuals across different government forest agencies.

In addition to the importance of officials' values, incentives and constraints shape behavior. Individuals respond to external rewards and sanctions, adjusting their behavior in ways calculated to improve chances of increasing the former and decreasing the latter. Incentives and constraints include statutes and regulations, planning documents, revenues, and employee performance evaluations. Numerous scholars have criticized incentives and constraints at the national level that foster unfavorable bureaucratic behavior (e.g., Leal 1993, O' Toole 1988).

A third factor expected to impact forest policy processes involves non-agency participants who seek to influence policy. Their participation may be linked to participation costs. As Downs (1957) suggests, lowering costs (effort) to participate may encourage a greater number of participants. Thus the use of notice and comment periods, public hearings, mailing lists, and other tools to solicit public input may lead to a greater number of participants in certain forests than in others. While these tools have frequently been used at the national level, they may be less prevalent at the state level (Peterson 1981).

In addition to the level of participation, it is also important to understand who participates. Sabatier et al. (1995) argue that local political pressure is one of the most important determinants of USFS forest plan decisions. Shepherd (1975) claims that, because USFS officials receive input primarily from influential timber, grazing, and mining interests, they favor forest management for commodity uses. Culhane (1981), however, suggests that the involvement of participants with diverse preferences leads the USFS to craft policy that balances development and preservation uses. Clearly scholars disagree about participation at the Federal level. Moreover, little information has been collected regarding state level participation.

Outcomes

In addition to research focusing on higher versus lower levels of government authority and factors influencing policy processes, a third area of inquiry relevant to this study is outcomes. Two types of outcomes are of particular interest, fiscal and forest uses.

Fiscal

A number of fiscal outcomes have been examined, including net profit from operations, user fees, and monetary transfers to local governments. First, scholars have examined revenues and expenditures to evaluate agency net profits from operations. Peterson (1981) argues that economic interests dominate local policies because local officials hope to attract mobile firms. Therefore, local officials are expected to provide industries with financial incentives, such as tax abatement and subsidized resources. The Federal government, on the other hand, is susceptible to a wider variety of groups pressing for economic

as well as non-economic benefits. National forests are also subject to the National Forest Management Act of 1976, which requires economic considerations in forest planning. Thus it is expected that states are more likely than the Federal government to provide subsidized benefits to attract firms.

However, forest management agencies in some states are statutorily mandated to maximize forest income, whereas the U.S. Forest Service's mandate is one of multiple-use, expressly not to manage strictly for the maximum dollar return. Thus state officials may be less likely to generate operational losses. For example, Leal (1993) argues that national forests in one state lost money on timber sales while nearby state forests earned profits. He attributes this result to environmental restrictions that caused higher labor hours per board foot of Federal timber sold and lower harvest quantities. Furthermore, numerous studies cite cases where Federal timber sales generate less revenue than the cost of sale preparation, making them "below cost" (see Rice 1989). Moreover, the Forest Service mission has traditionally included the provision of forest commodities to promote rural jobs. Such findings suggest that the Federal government is more, not less, likely than states to provide subsidized benefits such as below-cost timber.

A second important fiscal outcome is the extent of user fees, which can improve economic performance by more closely matching who benefits and who pays for a good or service. Krutilla et al. (1983, 555-6) state that individuals who make political demands for specific benefits without paying directly for them will demand more of those benefits than is socially optimal. Similarly, Robinson (1975) argues that charging user fees for recreation would generate revenue useful to provide a more efficient level of recreation benefits. Therefore he criticizes the low level of user fees collected by the USFS, which faces Congressional restrictions. States, on the other hand, are expected to charge user fees, as lower levels of government may focus more on fiscal equivalency (Stein 1990).

A third important fiscal outcome is the amount of funds transferred from the forest to the surrounding community. A common criticism by local governments is that public forests decrease their tax base. To make up for this, the Forest Service and several state forest agencies are required to transfer a portion of their revenues collected from users to local governments. While no systematic study has compared state to federal forest agency revenue transfer, arguments can be made either way regarding which level of government should transfer more revenue to local communities. On the one hand, the Forest Service mission has traditionally included a concern for local employment based on forest products; thus, the national level might transfer more money to local communities. On the other hand, to the degree that state forests are expected to collect more revenue than national forests, they might also share more funds with local governments than do national forests.

Forest Uses

Forest management involves the promotion of certain forest uses. Forests are capable of providing a wide range of benefits, from higher impact ones like timber, mining, and off-road vehicle trails, to lower impact benefits such as hiking, fishing, and nature study. Benefits linked directly to individual utility can be measured fairly readily. While no systematic study has compared state to national forest uses promoted, such a comparison is possible with the data collected in this study. Forest benefits with a market price can be examined in monetary terms, while those without an easily identifiable market price can be examined in units such as visitor days and trail miles.

For other forest benefits, however, measurement is more problematic. In particular, the set of ecosystem services that a forest provides is hard to measure. Evaluation and definition of ecosystem sustainability is highly controversial. While disagreements remain over this concept, several useful ecological components of forest sustainability have been suggested, including ecosystem-level management; large, connected habitat patches; identification and protection of rare species; ecosystem research and monitoring; and soil and watershed protection (see Aplet et al. 1993).

Methodology and Data

To test a number of hypotheses suggested by previous research, this study provides a series of structured, focused comparisons. The central question is "How do public forest policy processes and outcomes differ between the state and national level?" The unit of analysis, analytical approach, case selection, and data gathering techniques to address this question are described below.

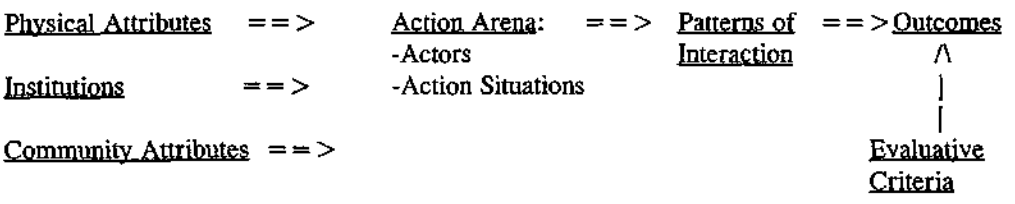
Unit of Analysis

The focus of this study is forest management policies made by agency decision makers. Legislative mandates are, without question, important. To understand how policy is made and its impacts, however, it is crucial to investigate activities as they are carried out on the ground. This emphasis reflects the recognition that forest policy, indeed any kind of public policy, is more than the enactment of law by legislatures; agency officials are important policy makers as they implement, interpret, and "fill in the details" of broader legislative directives. Furthermore, since agency policies are changed more frequently than are laws, a focus on agency decision making illuminates causes and effects of policy changes in finer resolution than would a focus on legislation.

Analytical Approach: The Institutional Analysis and Development Framework

Policy processes are conceptualized in terms of the Institutional Analysis and Development (IAD) framework, developed by Ostrom and colleagues (Ostrom et. al. 1994). This framework directs the researcher's attention to the physical world, institutions (rules), and the community, which affect actors in action situations (see Figure 1). Patterns of interaction among actors in action situations lead to outcomes.

Figure 1: The IAD Framework (from Ostrom, et al, 1994)



Attributes of the *physical world* relevant to forest management include factors such as topography, soil, and climate. The aim of this study design is to control, as much as possible, for these physical characteristics, thus highlighting the effects of institutions and the community.

Institutions and the *community* are both human artifacts. Institutions define what actions are required, prohibited, or permitted and the sanctions prescribed for transgressions (Ostrom et al. 1994, 38). Attributes of the community include common understanding, norms of behavior, homogeneity of preferences, and distributions of resources among members (Ostrom et al. 1994, 45). While nearby national and state forest officials share the community of a particular region of the United States, each agency has a unique organizational culture. Thus it is important to examine community attributes, to gain a better understanding of the organizations within which forest management occurs.

Actors in the IAD framework are characterized by their preferences, resources, information processing capabilities, and selection criteria for decision making (Ostrom et al. 1994, 33). In comparing state and national forest management, this study focuses on two of these elements, actors' preferences and resources.

Action situations are comprised of a set of participants who decide, based on information available to them, among alternative actions that are linked to outcomes (Ostrom et al. 1994, 29). This study focuses on action situations involving forest official decisions and activities relating to forest management. In comparing the two agencies, there will likely be differences in several elements, including who the participants are, what positions they take, and what information is available to them.

Of particular interest is the level of outside involvement by various interested parties attempting to influence bureaucratic decision making.

Action situations in the policy process can be examined in both formation (e.g., regulations, management plans, budget priorities, and policy statements) and implementation (e.g., harvesting products, monitoring users, enforcing rules, conducting research, and building trails). Actions taken in policy formation and implementation are linked to outcomes. For forest policy, these outcomes include activities undertaken, revenues generated, expenses allocated, funds transferred, and forest uses promoted and realized.

Case Selection and Data Gathering

The research presented here is a portion of a larger data collection and analysis effort. The completed work will include data from four cases, two in the Midwest and two in the Pacific Northwest. Each case is comprised of two forests, one state and one national, sharing similar location, climate, topography, and soils. To the extent that such pairs have similar physical characteristics, analysis highlights differences attributable to forest policy.

Information to test hypotheses about policy processes and outcomes comes from a number of techniques, including interview, observation, and document analysis. Much of the data are from semi-structured interviews with a variety of people. Interviews are useful for obtaining large amounts of data quickly, tapping into information from a wide variety of individuals, and discovering complex interconnections in social relationships (Marshall and Rossman 1989, 102). To complement interviews, observation provides additional data. Systematic observation of forest user activities, public meetings, and office environments can provide useful insights beyond individual perceptions. Additional data are generated through analysis of written documents, such as public reports, agency budgets, opinions, legislation, media accounts, memos, and questionnaires. Such analysis can provide objective data classification, useful documentation of major events, and the opportunity to generalize (Marshall and Rossman 1989, 95, 102).

Findings Reported in this Paper

For the purposes of this paper, a subset of variables is examined below, including statutes and regulations, forest management planning documents, fiscal outcomes, and management for timber and for ecosystem protection. The first two items are institutions (rules affecting benefits and costs to decision makers), while the latter two are outcomes. Analysis is performed on a full set of data from Case 1, and a nearly full set of data from Case 2, for a total of four forests (two in each case).

Results indicate several important differences between state and national forest institutions and outcomes. First, officials in the national agency (USFS) face greater statutory and regulatory constraints affecting their activities than do state forestry agency officials. These constraints require more public input and higher levels of environmental protection, and they give more leverage to groups opposing active management for timber. Second, compared to plan guidelines for state forest management, plan guidelines for national forest management are created with a greater level of input from non-agency participants and exhibit more environmental restrictions.

Given such differences in constraints, it is not surprising that national officials provide less timber, generating lower timber at higher unit costs, than do state officials. Concurrently, national forestry officials undertake greater efforts to provide non-timber environmental benefits than do state forestry officials.

Institutions

As previously explained, institutions are rules that define what agency official actions are required, prohibited, or permitted and the sanctions or rewards associated with those actions. An important set of institutions is the statutes and their implementing regulations that forest officials face in their day -to-day activities. Generally, agency officials working on the forests have little influence over statutes and regulations. Some of them do, however, influence a second major set of institutions — the forest planning document governing particular forests.

Statutes and Regulations

Agency officials are constrained by statutes and regulations that establish direction for forest management. The simplest directives are those providing the agency with its legal mandate. Other important statutes and regulations may constrain a variety of activities or outcomes. Moreover, the creation of legal standing for those opposing agency officials' decisions may further constrain those officials.

Legal Mandate

In each case, state and national mandates both include multiple uses. However, state agency mandates include a directive to promote commercial timber as a source of revenue or profit, while the national agency mandate does not (see Table 1). In fact, the USFS mandate described in the Multiple Use

Sustained Yield Act directs that the agency's management is "not necessarily [for] the combination of uses that will give the greatest dollar return or the greatest unit output" (16 USCA Sec 531a).

Table 1: Elements of Agency's Statutory Mandate

Explicitly Stated Elements	National 1 & 2	State 1	State 2
Multiple uses:			
Timber	Yes	Yes	Yes
Watershed/soil	Yes	Yes	Yes
Wildlife/fish	Yes	Yes	Yes
Wilderness	Yes	No	No
Range	Yes	No	No
Recreation	Yes	Yes	No
Aesthetics	No	Yes	No
Profitable timber	No	Yes	No
Commercial timber to provide source of revenue	No	No	Yes

Additional Statutes & Regulations

As indicated in Table 2, in both cases national official face more statutes and regulations affecting management processes and decisions than do state officials. State officials enjoy a greater level of discretion in planning processes, substantive components of forest plans, proposed activities, harvest methods, harvest quantity, and land exchange.

Table 2: Statutes and their Implementing Regulations Affecting Officials*

Activity or Outcome	National	1 & 2	State 1	State 2
Planning process	NFMA, NEPA	none	none	
Plan contents	NFMA	none	none	
Proposed activities	NEPA	none	none	
Harvest methods	NFMA	none	none	
Harvest quantity	NFMA	none	none	
Land exchange	FLEFA	none	none	

* Acronyms are as follows:
NFMA = National Forest Management Act
NEPA = National Environmental Policy Act
FLEFA = Federal Land Exchange Facilitation Act

Several officials indicated that these legal constraints significantly shape policy. For example, in Case 2, national officials were required to track public input and prepare a formal response addressing issues raised in over 7,000 letters and petitions received during the 90-day comment period for a Plan amendment (N2-1, 23). from the public. A national official in Case 1 indicated that, due to the large amount of preparation involved in complying with requirements, only a low level of timber sales could be prepared each year (Nl-A). Moreover, one state official who had previously worked in the national agency stated that NEPA represents one of the biggest differences between state and national forest policy making, because the national law leads to battles over procedures, where interested parties can stop proposed forest management activities (SI-A). State forest policy making, in contrast, is not constrained by such statutes. In Case 1, one state official (Sl-B) commented, "We have created most of our silviculture parameters, not the legislature." Similarly, in Case 2, one official (S2-A) said that, other than for wetlands or earth moving work, no legal constraints directly affect forest management activities.

Legal Standing for Citizen Appeals

Proposed forest management activities on the national forests are subject to delay or blockage from public appeals. NEPA and NFMA, and their implementing regulations, prescribe processes for citizens to appeal, at multiple levels within the national agency, proposed activities. Opponents of forest management activities can and do use the appeals process. For example, in Case 2, all three timber sales in the last four years on the national forest have been appealed. In Case 1, a national official (Nl-B) said that unless the letter of the law is precisely followed in planning a given timber sale, then an environmental group will successfully appeal it. Thus he devotes significant effort trying to make proposals "appeal proof." In contrast, such decisions are not subject to appeal in the state forests; citizens are not able to block or delay management activities through administrative or judicial appeals.

Planning Documents

Determining forest management activities involves more than compliance with pre-existing statutes and regulations. State and national agency officials must also develop plans to chart management direction. Such planning documents (national forest plan, or "the Plan," and state planning manual) are developed for a particular forest or set of forests, taking into consideration conditions on the ground.

Restrictions on Activities

Forest planning documents describe criteria for determining which activities are appropriate in what places. They establish rules for certain practices, including timber stand improvement, snag provision, forest opening sizes, protected zones, and protection of riparian areas. Analysis of these plans indicates that, as is the case with laws and regulations, national forest officials face greater constraints from their planning document than do state officials (see Table 3).

Table 3: Restrictions Included in Planning Documents

	Agency Facing More Requirements for Environmental Protection:	
Activity or Condition	Case 1	Case 2
Timber Stand Improvement	National	Equal
Leaving Snags After Harvesting	National	National
Regeneration Opening Size	National	State
Protected Zones	National	National
Riparian Areas	Equal	National

Totals: National agency is more protective 7 times
State agency is more protective 1 time
Levels of protection are equal 2 times

Timber stand improvement (TSI) activities, which ordinarily involve removal of certain trees to increase growth in other trees, are subject to guidelines in the agencies' planning documents. While TSI restrictions are similar for the agencies in Case 2, in Case 1 the national agency faces more restrictions.

"Snags" are trees that are usable for wildlife habitat but not timber. In both cases, national requirements for the quantity of snags to leave are stricter than state requirements.

Forest openings are areas where overstory canopy is not present, usually because all trees in the area have been harvested. While forest openings can provide cost-effective timber harvesting, they also may detract from aesthetic values and forest ecosystem conditions. In Case 1, national restrictions limit forest opening sizesmore than do state restrictions, but in Case 2, state restrictions are stricter.

Management planning on state and national forests in these two cases includes designated zones in which timber harvesting and other activities are restricted. For example, certain areas are zoned to allow all types of harvest methods, while in other areas only lower impact methods such as single-tree selection are permitted, and in still other areas no timber harvesting is allowed at all. In both cases, a higher proportion of land area is in more protected zones in the national forest than the state forests.

Riparian areas are lands that serve as a transition from aquatic to terrestrial ecosystems. In Case 1, the national Plan places similar restrictions on activities in riparian areas as the state planning document. However, in Case 2, national restrictions are more stringent.

Outcomes

Given the significant differences evident in institutional factors described above, it is important to examine what, if any, differences in outcomes are present. Analysis of several fiscal and forest use outcomes reveals important differences between state and national forest management.

Fiscal

As with analysis of any natural resource, one important forest outcome involves fiscal measures. Costs to provide timber, the primary commodity, in two of these forests are compared below. A second important fiscal measure examined is revenue transferred to local governments.

Costs to Provide Timber

As is common throughout the United States, timber sold from public forests in these cases is not primarily harvested by agency officials. Instead, the right to harvest is sold to contractors who bid for specified standing trees (called "stumpage"). Agency officials undertake activities to prepare stumpage for sale, which require time and material resources. Activities may include forest cruises (inventories), timber stand improvement (e.g., cutting vines from trees), and marking of trees. They may also include sale administration activities such as sale announcements, contractor meetings, contract administration, and monitoring of contract compliance.

In both cases, the state agency sold its timber at a lower cost per board foot of timber than did the national agency (see Table 4). In Case 1, timber costs include sale preparation and administration, as well as TSI activities. For fiscal year 1995, timber costs on state forests were estimated to be $483,665 to provide 5.4 mmbf (million board feet), which equals $0.09 per board foot. Timber expenses on the national forest totaled $211,868 to provide 1.5 mmbf, or $0.14 per board foot.

In Case 2, timber costs include sale preparation and administration activities but not TSI activities, since the state does not track the latter expenses. For fiscal year 1995, timber costs on state forests were estimated to be $ 73,166 to provide 3.2 mmbf, which equals $0.02 per board foot. Timber costs on the national forest totaled $69,295 for 1.0 mmbf, or $0.07 per board foot.

Table 4: Timber Expenses, Fiscal Year 1995

Agency	Timber Costs*	Volume (mmbf)	Unit Cost (per bf)
State 1	$483,665	5.4	$0.09
National 1	$211,868	1.5	$0.14
State 2	$ 69,295	3.2	$0.02
National 2	$ 73,166	1.0	$0.07

* For Case 1, costs include sale administration and TSI activities. For Case 2, only sale administration costs are included.

Higher timber provision costs on the national forest can be attributed to several factors. First, as discussed in "Statutes and Regulations " above, national officials must comply with a greater number of legal constraints on timber management, which require greater agency resources. For example, timber sales are normally offered only after the area in which the trees are located has undergone a thorough (and costly), interdisciplinary environmental assessment and "opportunity area analysis." Second, timber production exhibits significant economies of scale (USDA Forest Service 1995, p. 15). Certain costs such as planning documents, environmental assessments, and personnel are substantial even for small timber sales, where they contribute to high unit costs. Thus, relatively low timber sale volumes exhibit higher unit costs to provide, which lowers unit profitability.

Revenue Transfers to Local Governments

A frequent charge levied against public lands is that they displace revenue that would otherwise be collected from private owners for the local tax base. To counter this charge, statutes may require a certain proportion of agency revenue earned in a particular location to be shared with the corresponding local government. In fact, officials at the national and state agencies in both cases face such requirements. The national transfer amount is calculated as 25 % of gross revenues from all sources (timber, camping fees, leases, special use permits, etc.), while transfer amounts in both states are a fixed percentage (50 % in one state, 15 % in the other) of net revenue from commodity production (primarily timber, but also oil/gas/minerals in one state).

In Case 1, the national agency shared $15,554 with local governments in fiscal year 1995, compared to $721,769 from the state agency (see Table 5). In Case 2, the national agency shared $13,755 with local governments, compared to $120,867 from the state agency. With revenue sharing based on net rather than gross earnings, and a narrower range of revenue sources subject to sharing, it is, perhaps, surprising that the state agency in both cases actually transferred more funds to local

governments than did the national agency. This outcome can be explained by the higher level of commodity production by the state agencies, which provides a higher revenue base to which the sharing formulae are applied.

Table 5: Forest Agency Revenue Sharing with Local Governments, FY1995

Agency	Accrued to Local Governments*
State 1	$721,769
National 1	$ 15,554
State 2	$120,867
National 2	$ 13,755

*from statutory percentage of revenue or net profit earned by the forest agency

Management for Which Uses

In addition to fiscal measures, it is important to understand differences in forest uses across government levels. Forests may be managed for timber production, in which case it is useful to know the volume of wood provided and the corresponding proportion of annual growth (the maximum level of timber that could be produced without depleting the stock of trees). A different objective is ecosystem protection, which can be measured in terms of specific management efforts. (A third set of management objectives involves different types of recreational uses, a subject that is beyond the scope of this paper but included in the larger research project.)

Timber

Timber production depends on both the supply of tree growth, which is based on site productivity, and the quantity of timber that agency officials prepare for sale. Average estimated site productivity, the capacity of a given unit area of land to grow trees, is similar across the state and national forest land in each case. Differences in forest size, however, yield different total estimated annual growth. (For example, two forests each capable of growing 150 board feet per acre per year will produce different total quantities of growth if one forest is twice as large as the other.) Thus a useful indicator of timber production is the proportion of annual growth sold. In both cases, the differences are dramatic, with the state agency proportion of timber sold running about four times that of the national agency (see Table 6).

Table 6: Quantity of Timber Sold and Percent of Annual Growth, FY 95

	Timber Sold (mmbf*)	Annual Estimated Growth (mmbf)	Share of Annual Estimated Growth Sold
State 1	5.4	27.6	19.6 %
National 1	1.5	32.3	4.6 %
State 2	3.2	17.0	18.8 %
National 2	1.0	19.0	5.1 %

*mmbf = million board feet

Ecosystem Protection

As we continue to expand our understanding of environmental interconnectedness, it becomes increasingly evident that forest health must include more than just the traditional focus of protecting trees from wildfires, pests, and diseases. Rather, an underlying condition necessary for sustainable forest uses is a healthy forest ecosystem.

Management for ecosystem protection is not easy to measure. Experts disagree not only on which management activities lead to healthier forest ecosystems, but also on what healthy forest ecosystems look like. No single indicator can accurately measure ecosystem protection, but a number of indicators are useful, including efforts to promote ecosystem management; identification and protection of rare species; ecosystem research and monitoring; the provision of large, connected forest patches; and soil and watershed protection. These measures, taken together in Case 1, suggest that national officials provide more extensive efforts for ecosystem protection than do state officials (see Table 7). Data are not yet available for Case 2.

Table 7: Ecosystem Protection Efforts (Case 1)

Indicator	Agency with Greater Efforts
Ecosystem Management	National
Protect rare species	National
Monitor Ecosystem	National
Manage large patches	Equal
Protect soil/water during harvest	Equal

Total: National agency has greater efforts 4 times
State agency has greater efforts 0 times
Efforts are equal 2 times

To measure *ecosystem management*, agency officials were asked to rank, on a scale of -2 ("strongly disfavor") to 2 ("strongly favor"), the degree to which their agency's policies manage "for forest ecosystems, even if that means reducing direct benefits to people." National officials' responses were all either 1 or 2, for a mean value of 1.17, compared to state officials' responses ranged from -1 to 1, for a mean value of 0.14. Thus national officials perceive their agency performs ecosystem management more than state officials do.

Further evidence for greater national emphasis on ecosystem management comes from the process of vegetative manipulation. On state forests, a local forester does a reconnaissance "cruise," focusing data collection on trees, from which he or she writes a management prescription. If a timber sale is recommended, the forester seeks approval from a higher-level forester in the central office, who initiates the contracting process. In contrast, on the national forest, before a forester performs a cruise, an interdisciplinary team of scientists performs an Opportunity Area analysis for a large tract (10,000 to 60,000 acres). The team examines a wide variety of resources, including cultural, biological, visual, soil and water, vegetation, recreation, and transportation. Any subsequent timber sale recommendations are included in an environmental analysis, and a decision to sell timber is subject to appeal.

Indicators of efforts to *identify and protect rare species* include projects carried out on the public forests. On the national forest, in fiscal year 1995, officials undertook numerous projects to identify and protect rare species, including monitoring the population of a regionally sensitive sparrow and developing a plan to enhance its habitat, studying songbird species richness, and monitoring specific species for possible addition to rare species lists. Such work is performed by staff specialists, including a botanist, two wildlife biologists, and two ecosystem technicians.

Proactive species and identification efforts on state forests are limited. As one official (Sl-C) commented, "We check timber sales areas in the rare species database [maintained by another state agency], but we don't go looking for species, and we don't inventory every acre." In fact, unlike the national agency, the state agency does not hire full-time botanists, wildlife biologists, or ecologists to pursue rare species work on the public forests.

An indicator of *ecosystems research and monitoring* is the level of resources devoted to such activities. The national agency devotes considerable effort to ecosystems research and monitoring. In fiscal year 1995, nearly $550,000 was spent on ecosystem efforts. These expenditures covered costs of data gathering, inventorying, and monitoring outside the scope of particular projects. For example, opportunity area analysis work is partially funded through this line item. Another effort involved inventorying an aquatic ecosystem related to a creek. The most significant ecosystem research project is ecological classification efforts, which will help agency officials to better understand different ecosystems for future planning [Nl-A].

The state agency devotes little effort to such ecosystems research. As one official [S1-B] explained, "We don't do much ecosystem monitoring; just the cruise that focuses on overstory." The only ecosystems research work undertaken in fiscal year 1995 was a pilot study, based on EPA guidelines, that involved test plots to measure soil conditions, topography, vegetation, and other ecosystem components. But one official predicted that the study will not be continued, since "monitoring [the whole forest community] is time consuming and doesn't provide commercial timber information that we need" [Sl-B].

Managing *large, connected forest patches* is conditioned on agency jurisdiction over such tracts. While state and national forests in both cases are highly fragmented, due to previous private ownership, officials on the state and the national forests attempt to piece together larger patches through land acquisition. In prioritizing tracts to acquire from willing sellers, officials of both forests place a high value on acquisitions that will consolidate larger forest patches.

The final indicator of ecosystem protection is the level *of protection of soil and watersheds* during timber harvesting, which has the potential to lead to soil erosion and watershed siltation. Since, in most cases, agencies contract out harvesting operations to private parties, efforts to minimize harm to soil and watershed take the form of restrictions on contractors and monitoring for compliance.

Both state and national officials place similar restrictions on harvesters, regarding harvest season, road construction, erosion control devices, and other precautions. They also report similar levels of monitoring to ensure that contractors are in compliance. Moreover, harvesters on both state and national forests are required to submit a performance bond to provide additional incentive for contract compliance.

Conclusion

While the above analysis focuses on a subset of the variables examined in the larger study, the results are striking. National officials face greater institutional constraints affecting their activities than do state officials. These constraints contribute to lower levels of timber production, at higher unit costs. Subsequently less revenue is transferred to local governments. But national officials do appear to devote greater efforts toward ecosystem protection than do state officials.

An important next step in understanding more general policy process and outcome differences between state and national agencies is to continue examination in additional cases, in another geographical region of the United States. Upcoming data gathering and analysis in the Pacific Northwest will provide useful variation in physical conditions as well as institutional and community attributes, yet continuity in variables examined, to further increase understanding of important natural resource policy phenomena in the federal context.

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