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Forest Policy and Economics 9 (2006) 32–41
Forest Policy and Economics
www.elsevier.com/locate/forpol

Forest Plans and ad hoc scientist groups in the 1990s: Coping with the Forest Service viability clause

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Received 18 November 2004; received in revised form 9 February 2005; accepted 11 February 2005

Abstract

The National Forest Management Act (NFMA) of 1976 requires U.S. National Forests to develop Forest Plans every 15 years to guide their actions on the forest. The 1982 NFMA implementation regulations require the Forest Plans to provide for "species viability." Throughout the 1980s, plans were written to meet this charge. In the Pacific Northwest, many plans were subsequently challenged on their ability to provide for species viability; ad hoc science groups were then commissioned to assess the plans relative to the viability standard. The ad hoc groups universally concluded that the plans provided inadequate species protection, and recommended major management changes based primarily on decreases in timber production. The Northwest Forest Plan and the Interior Columbia Basin Ecosystem Management Plan were both developed, in part, from ad hoc science teams' recommendations. Through interviews and an examination of numerous Forest Plans, we explore how two such divergent outcomes could result from the same set of planning regulations. Four propositions are discussed: (1) The planners and ad hoc science groups characterized risk differently. (2) The ad hoc science groups raised the bar relative to what was needed to ensure protection. (3) The agency was not able to introduce change into its own organization. (4) Changing social values and increased appeals to the court system forced a change in the agency's priorities.
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Keywords: National Forest Management Act; Species viability; Northwest Forest Plan; Interior Columbia Basin Ecosystem Management Plan; Ad hoc science groups; Forest Plans

1. Introduction

The National Forest Management Act (NFMA) of 1976 instituted national forest management plans, to be renewed every 15 years on each of the 175 National Forests that comprise the 59 million hectare system. Planning regulations developed from NFMA

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doi:10.1016/j.forpol.2005.02.001

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were implemented in 1979, then revised in 1982. The 1982 regulations introduced the concept of "species viability" to planning (the Act had used only the word "diversity"), and it was under the 1982 regulations that Forest Plans of the 1980s came into being.

Many of the national Forest Plans written in the Pacific Northwest in the mid-1980s were immediately challenged on their ability to protect viability of species and ecosystems. Ad hoc science groups commissioned to explore and improve the scientific basis of the plans, such as the Interagency Scientific Committee (ISC) (Thomas et al., 1990), Gang of Four (Johnson et al., 1991), Forest Ecosystem Management Assessment Team (FEMAT) (FEMAT, 1993), and the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Quigley et al., 1996), all concluded that the Forest Plans provided only low levels of protection for species viability and ecosystems.

The ad hoc science groups, still acting under the 1982 regulations, then provided options they believed met the viability standard, options which would require significantly different kinds of management across large landscapes. For social and political reasons beyond the scope of this paper, many components of the various ad hoc groups' options have never been implemented (Thomas, 2002; Milstein, 2003). However, even amended versions of the ad hoc groups' new options did result in major changes in the management and perception of the National Forests.

The shift from one management approach, focusing largely on commodity production, to the other, focusing largely on species viability, happened over only a few years. The first Record of Decision on a Forest Plan after NFMA was published in the Federal Register in 1987; the first of the ad hoc science groups, the ISC, published its report in 1990. We are investigating what changes prompted the discrepancies on viability standards between the Forest Plans of the mid- to late-1980s and the proposals put forward by ad hoc science groups starting in 1990. Why such divergent outcomes from the same set of planning regulations?

1.1. Ad hoc science groups

On the west side of the Cascades Mountains, throughout the range of the Northern Spotted Owl (*Strix occidentalis*), Forest Plans were reviewed and new viability strategies were developed by several ad hoc scientific committees. We discuss three of the most influential of these committees. (1) The ISC was created in 1989 by an interagency agreement between the USDA Forest Service, the USDI Bureau of Land Management, Fish and Wildlife Service, and National Park Service. It was commissioned to address the conservation of the northern spotted owl, and to develop a scientifically credible conservation strategy for it (Thomas et al., 1990). (2) The Scientific Panel on Late-Successional Forest Ecosystems (commonly referred to and hereafter, Gang of Four), was commissioned in 1991 by the U.S. House of Representatives Committee on Agriculture, and the Committee on Merchant Marine and Fisheries. They were tasked with identifying ecologically significant old-growth forests, developing and evaluating management options and protection strategies, and quantifying the economic impacts. The scope of their report expanded beyond the owl to include potentially endangered fish stocks and late-successional habitat generally. The Gang of Four Report made no recommendations but instead weighed the relative risks associated with a host of management alternatives. (Johnson et al., 1991) (3) FEMAT was created by President Clinton following the Forest Conference in Portland Oregon in 1993. The group was charged with identifying management alternatives that attain the greatest socio-economic contributions from the forest while meeting all applicable environmental laws (FEMAT, 1993). The alternatives developed in the FEMAT report were used, but were substantially altered in the development the Northwest Forest Plan (NWFP) (Thomas, 2002). The NWFP continues to govern–under considerable social and political pressure for change–the federal lands within the range of the spotted owl.

East of the Cascades, ad hoc scientific assessments reviewed the management strategy under the Forest Plans and recommended changes that would meet the viability requirements of the NFMA. We focus on ICBEMP. This assessment was a directive from President Clinton in 1993, who sought an ecosystem-based strategy for east side forests. This time the attention was on fish rather than owls, and because some runs of salmon were already listed on the Endangered Species Act (ESA), regulatory agencies were brought in to work with managers. A 1996

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report, Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin, summarized its assessment of the region and analyzed scenarios toward three different views of the future, one of which was the management strategy developed by the Forest Plans. The ICBEMP plan, after nine years in development, was shelved by the Bush Administration in February of 2003.

2. Methodology

To consider the nature of the changes, we took a three-pronged approach in our research. A brief literature review provided a summary of current scholarly views of institutional and organizational change, environmental politics and policy, species viability protection, and changing social values in the 1970s and 1980s.

We then examined an array of Forest Plans published in the late 1980s, and a selection of assessments subsequently developed by ad hoc science groups. The plans and associated environmental impact statements we examined came from the Siuslaw, Willamette, Umpqua, Deschutes, Gifford-Pinchot, Malheur, and other National Forest Plans (USDA Forest Service, 1990a,b,c,d,e,f). We also examined the documents relating to findings by the ad hoc science groups. These included the ISC report (Thomas et al., 1990), the Gang of Four report (Johnson et al., 1991), the FEMAT report (FEMAT, 1993), and the ICBEMP assessment (Quigley et al., 1996).

Next we interviewed 10 people who had been involved with the planning process, either with Forest Plans in the 1980s, with ad hoc science groups in the 1990s, or in some cases with both (see Table 1 for a description of the interviewees). This sample was based on availability of qualified interviewees within

Table 1

	Development Forest Plans	Development of ad hoc assessments
Sally Collins	*Forest Supervisor:* Deschutes N.F., late 1980s and 1990s. *Planner:* Siuslaw N.F., 1980s. (Now Associate Chief of the Forest Service.)	Not involved.
Mike Kerrick	*Forest Supervisor:* Supervised the ID teams on the Willamette N.F. throughout the planning process. (Now retired.)	Not involved.
Jim Sedell	*FS Fish Biologist:* Helped review the fish and aquatic portion of the Siuslaw Forest Plan. (Now PSW Research Station Director.)	*FS Fish Biologist*: Co-lead for aquatic and watershed strategy in ICBEMP; co-lead for aquatic and watershed strategy in FEMAT; co-author of the aquatic portion of the 'Gang of Four' Report.
Eric Forsman	*FS Owl Biologist:* Assisted in development of PNW Regional Guide; member of all owl review teams from 1973.	*FS Owl Biologist*: Member of ISC; member of FEMAT.
Gordon Reeves	*FS Fish Biologist*: reviewed and commented on all PNW Forest Plans affecting fish.	*FS Fish Biologist:* Co-lead for aquatic and watershed strategy in ICBEMP; co-lead for aquatic and watershed strategy in FEMAT; co-author of the aquatic portion of the 'Gang of Four' Report.
Tom Quigley	Not involved.	*FS Wildlife Biologist:* ICBEMP science team leader. (Now PNW Research Station Director.)
Dick Phillips	*FS Economist*: Member of regional planning teams on Modoc, Gifford-Pinchot, and Mt Hood, N.F.; part of Eisenhower Consortium traveling around country training teams and supervisors on economic and Forest Plan analysis.	Not involved.
Andy Stahl	*Environmental Activist*: Worked for the National Wildlife Federation and the Sierra Club, which challenged the Regional Plan with regard to old-growth and the spotted owl.	*Environmental Activist*: Worked for National Wildlife Federation and the Sierra Club who challenged the Ad hoc Plans concerning old-growth and the spotted owl.
Grant Gunderson	*FS Wildlife Biologist:* Briefly involved in Forest Plans on the Ochoco; worked on Regional Guide and SEIS. (Now retired.)	*FS Wildlife Biologist:* On terrestrial team in FEMAT; Assisted in 'Gang of Four' Report.
Harriet Plumley	*FS Planner*: Operations research analyst for the Gila N.F.; Interdisciplinary Team Leader for Siuslaw Forest Plan. (Now retired.)	Not involved.

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a certain time frame. Semi-structured interviews allowed us to loosely tabulate responses into categories to compare responses thematically, and also to ask follow-up questions that enriched their insights.

The framework that best suited our data was a series of four hypotheses, or working propositions, which we present below. Each is considered in light of the plans, the ad hoc science reports, and the comments of interviewees.

3. Hypotheses/propositions

3.1. Forest planning groups and ad hoc science groups assessed the same management scenarios regarding viability, and foresaw two different outcomes

Prior to the 1982 planning regulations, requiring the Forest Service to manage fish and wildlife habitat to "maintain viable populations of existing native and desired non-native vertebrate species… well distributed in the planning area" (36 CFR 219.19), managers and planners on National Forests across the country had not had to analyze risks to species viability. In general, interviewees agreed that they were constrained by personnel, by lack of data and suitable tools, and by the fact that viability analysis was a new science with little consensus on its application in management settings. Comprehensive viability analysis requires significant data inputs on species demography and life history that are, to this day, unavailable for most species (Ruggiero et al., 1994).

Finding sufficient data often depended on the skills of a single wildlife biologist on each interdisciplinary team (ID Team) (Plumley, Phillips, Kerrick, personal communication). This contrasts with the ad hoc assessment teams, typically made up of research scientists and university professors who were considered current with the scientific literature, and often the best in their fields. These differences shaped the lens through which the Forest Plans were viewed.

The models available to the planners were also out of sync with the needs of viability assessments. FORPLAN, a "trade-offs" or optimization model based on linear programming, was used extensively in planning across the National Forest System. In contrast, the subsequent ad hoc assessments viewed the planning area as part of a dynamic ecosystem which revealed the model's weakness in dealing with cumulative effects and other nonlinear analysis demanded by the viability concept (Phillips, personal communication; Johnson, 1992).

Nonetheless, the Forests were tasked with the management planning process, which now included addressing viability. Plans were finalized and published after a National Environmental Policy Act (NEPA) analysis and were believed by their authors to have met the viability requirement. For example, the Final Environmental Impact Statement (FEIS) for the Malheur National Forest Plan shows significant increase in fish habitat capability over the life of the plan and into the next 50 years (USDA Forest Service, 1990b). The Deschutes Forest Plan noted that its 50-year future condition projection showed "Fish habitat has been maintained and improved to meet fish production targets" (USDA Forest Service, 1990a).

But when the ICBEMP science team reviewed these and other Columbia Basin plans they predicted a very different outcome. In a chart that characterized the risks to key salmonid species, the Forest Plans were shown not to conserve or restore populations of any salmonid species (Quigley et al., 1996 p.147). A coarse-grain aquatic ecosystem characterization of the Forest Plans also describes the plans as inadequate (Quigley et al., 1996).

There were also differences of opinion within the range of the spotted owl, west of the crest of the Cascades. The Willamette Forest Plan, in looking at species diversity in the Forest in 50 years, noted that populations of species dependent on mature and old-growth habitat will be stable and remain above viable levels. More generally this plan states that in 10 years, habitat for species will provide vegetation needed to sustain viable populations (USDA Forest Service, 1990f). Similarly, on the Siuslaw NF, planners anticipated litigation but had been reassured by the Regional Office and Washington D.C. that they had met the requirements of the law (Plumley, personal communication).

Their suspicions of a challenge were rapidly confirmed. The westside Forest Plans of the 1980s were found, first by environmental groups, and then by members of early ad hoc science groups, to have come up short. The ISC Report, issued in 1990, stated: "We believe that the current situation–that is,

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the lack of a well coordinated, biologically based management plan applied consistently throughout the range of the spotted owl–is unacceptable and has contributed to a high risk that spotted owls will be extirpated from significant portions of their range" (Thomas et al., 1990). In 1991, the Gang of Four report ranked the Forest Plans within the range of the spotted owl as "low" or "very low" in each of its five risk assessment categories (Johnson et al., 1991).

Clearly, the forest planners and the ad hoc science groups characterized the risk associated with plans differently. But why? Was it that the science, data, and methods were changing so rapidly that projected viability outcomes could vary widely over a short time? While all interviewees allowed that research was successfully scrambling to produce new data and models, many of the biologists involved with ad hoc science groups acknowledged that they, too, were at the mercy of limited or just-developing data. (Forsman, Gunderson, Reeves, personal communication).

3.2. The level of acceptable risk was set lower by the ad hoc science groups

The consistent feature of all plans written by ad hoc science groups was a lower level of acceptable risk than Forest Plans had proposed. Put another way, the bar on meeting viability requirements was raised; no longer would commodity production supercede viability when developing management strategies on the forest. Though first articulated by the Gang of Four report, all the science teams acknowledged in some way that there could be "no free lunch—that is, no alternative provides abundant timber harvest and high levels of habitat protection" (Johnson et al., 1991). The recollections of interviewees bear out this finding.

The Forest Plans were seen by those involved as timber management plans (Phillips, Plumley, personal communication). At most, species viability was considered just one of a dozen or so attributes to be balanced (Kerrick, personal communication). This contrasts with each of the ad hoc assessments, whose primary mandate was to provide for species protection on the forest, and then see what commodities were left. Notably, the search for a "scientifically credible conservation strategy" via the ISC put scientists in a truly influential position for the first time.

On the west side of the Cascades, several plans openly stated that they were choosing alternatives that did not offer the highest levels of protection. Some were quite specific about poor expected outcomes for viability. The Umpqua NF states in its FEIS, "Due to the very high amount of first decade road construction and the moderate to high levels of harvest, (the chosen alternative) has a high risk of unanticipated adverse effects to the fisheries resource" (USDA Forest Service, 1990e). At least three of the considered alternatives in the Suislaw FEIS had lower levels of expected landslide sediment load, and a higher smolt capability index than the final alternative selected. Managers there chose the status quo for expected numbers of landslides associated with logging and road building, even though coho populations had been crashing due in part to scour associated with these landslides (USDA Forest Service, 1990c). The final Siuslaw plan says about future fish populations: "Planned rates of timber harvests on upland areas will not be low enough to allow rapid recovery" (USDA Forest Service, 1990d).

Perhaps the most obvious story of the decreasing levels of acceptable risk from the ad hoc groups is told in the declining timber harvest volumes. Under the management direction of the Forest Plans and the Regional Guide's direction on spotted owl protection, the expected annual sale quantity (ASQ) was 4.4 billion board feet (Johnson et al., 1991). Option 9 in FEMAT, the preferred alternative, derived an expected annual sale quantity of 1.1 billion board feet—a 75% decrease (FEMAT, 1993).

Minimum management requirements in the Regional Guide had allowed a wide margin. Margins began closing quite sharply once the owl was declared threatened under the Endangered Species Act (1973) in July 1990, and the planning landscape changed accordingly. At first, many biologists believed, as had National Forest planning teams, that small, isolated old-growth reserves scattered throughout the landscape would essentially take care of viability protection requirements (Forsman, Sedell, Reeves, personal communication). But as new data poured in from the field, the acreage required just for protection of the owl rose from the initial 30 to 300, then to 1000, then 3000.

The ISC had only the owl as a focal species, but had to examine five criteria for measuring its viability (Johnson, 2000). Within a year, the Gang of Four was

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asked to consider the owl, fish, and late-successional/old-growth habitat generally. By the time FEMAT was convened, the number of species under consideration was over 1000 (FEMAT, 1993). Notably, the 1982 regulations required protecting vascular plants and vertebrates. However, without any specific legal impetus, FEMAT had increased the scope to include non-vascular plants and invertebrates.

It was perhaps inevitable that the bar of protection would rise across the board as the scale of planning expanded beyond the unit and forest level. Forest planners did not consistently look outside the boundaries of the forest, and received highly variable encouragement to do so (Collins, Phillips, Plumley, personal communication), while the ad hoc teams on both sides of the Cascades were mandated to consider landscapes that were orders of magnitude larger. For example, the Deschutes NF plan's goal for fisheries, was "to manage stream and lake resources to achieve a broad variety of fishing experiences which are responsive to public needs, resource capabilities and supportive of cooperative targets established with Oregon Department of Fish and Wildlife" (USDA Forest Service, 1990a). The emphasis clearly rested more on recreation opportunities and extraction within the forest than providing for viable populations of resident and ocean-going fish, an idea that stretched far beyond the boundaries of each forest. Once the ICBEMP science team was in place, the view of fish changed to a resource whose habitat protection required attention to the health of whole watersheds (Reeves, Sedell, Quigley, personal communication).

Species protection had moved from its traditional role as constraint on timber production to its new, central role as the driver of planning and management on federal lands, with timber as a residual resource (Phillips, Plumley, personal communication). A closer look at the Forest Service as institution provides useful insight into this period of turmoil.

3.3. The Forest Service was incapable of introducing change that threatened the status quo

The Forest Service has since its inception labored under conflicting mandates. The agency is expected to provide the public with products and services like timber, forage, fish and game, and recreation, many of which conflict. At the same time, it is required to ensure that these uses do not impair forest health, productivity and other amenities such as soil, biological diversity, and scenic beauty. Reaching this balance was possible during the 1950s and 1960s because the land base was large enough to absorb all these expectations, but as demand for products and services increased, the "balance" became harder to define (Hirt, 1994), especially as the strength of opposing positions grew in the public arena.

The housing boom that followed World War II marked the beginning of the industrial model of timber production for the Forest Service. Consensus and confidence within the agency had relegated non-timber values and conservation management to a secondary position behind efficiency (Hirt, 1994, 1999). Each year the agency would enthusiastically strive to meet the Congressionally mandated ASQ. The tools used by agency planners, such as FORPLAN, were originally designed to maintain timber production as paramount. This worked well until it was used to assess cumulative impacts of planned actions: FORPLAN is a linear programming approach which cannot accommodate the nonlinear analysis typically involved in cumulative effects analysis (Johnson, 1992).

During development of Forest Plans in the 1980s, the agency remained unwilling to restrain its short-term economic objectives to conform to its longer-term social and environmental objectives (Hirt, 1999; Johnson, 2000). Interviewees generally agreed that the Forest Service had become by default a timber agency. Universally, they acknowledged that the agency's apparent inability to adhere to its own rules continually undermined its public image through the later 1980s and 1990s.

The history of institutional behavior shows how unfavorable information often fails to reach the top decision makers; "favorable" information–that which supports the ambitions and survival needs of the organization–regularly gains full passage to the top (Bella, 2001). It is also common to see technical information set aside unused in the making of both strategic and tactical decisions, and to see outside groups reach more rapid conclusions in planning and management options than long-standing internal departments (Rayner et al., 2002; Walker et al., 2001). Cycles of adjustment in decision making and adaptation can involve creating temporary institu-

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tional structures such as the ad hoc science groups (Gunderson, 1999). The long planning time-frame and internal constituencies of planners within a bureaucracy generate different priorities and outcomes from the short project time-frame, external constituency viewpoint of ad hoc science groups.

The role of science as advisor, although called for in the 1982 planning regulations, had not been consistently pursued by the Forest Service for forest planning. The failure of the Forest Plans is seen by some as the result of not having a scientifically credible baseline; thus the plans offered only illusory choices (Johnson, 2000). The need for a stronger science component was behind the commissioning of the ad hoc groups, and played an ongoing role in them. The ISC and Gang of Four were scientist-only groups. The FEMAT group was almost exclusively scientists. The ICBEMP science team incorporated a science consistency check (Everest et al., 1997) that would ensure that the 'best available science' had been put to proper use in the proposed management strategies.

3.4. Changing social values, combined with increased appeals to the courts, drove the policy trend away from commodity production towards wildlife conservation

The host of environmental laws passed in the late 1960s and 1970s (e.g. NEPA, ESA, Resources Planning Act, NFMA, Clean Water Act) represented a sea change in public expectations of natural resource agencies. Some scholars have characterized the social forces at work in these decades as a shift in environmental paradigms, a change from the anthropocentric, Dominant Social Paradigm to the biocentric New Environmental Paradigm (Kuhn, 1962; Dunlap and Van Liere, 1978; Steel et al., 2003). The 1980s saw record numbers of new members joining national environmental groups (Bosso, 2000). All interviewees acknowledged social change, particularly environmental values, as a strong driver in steering planning onto a dramatically altered trajectory.

Numerous events contributed to a growing sense of the need for change in environmental policy. Examples include Rachel Carson's *Silent Spring* in 1962, the Santa Barbara oil spills in 1969, the 1973 Arab oil embargo, Love Canal in 1978. By the 1980s, the public's increased pessimism about environmental issues was palpable.

Subsequently, increasing membership meant new financial and political resources were available to environmental groups. They quickly developed skills at inciting concern over the despoiling of public lands. In just one example in the Pacific Northwest, the division between urban and rural populations was easily exacerbated by the early characterization of the debate as 'owls versus jobs.' This both over-simplified the problem and ignored the fact that mechanization and log exports had long since started to displace jobs in rural resource-dependent communities (Stahl, Forsman, Gunderson, personal communication).

The Forest Plans emerging in the late 1980s were the first round of plans to be subject to the new suite of environmental laws. Given the changing environmental awareness, the perception of an agency turning a blind eye to the cumulative environmental effects of its actions nationwide was bound to run into litigation. Quite rapidly, the courts took change out of agency hands.

The first preliminary injunction involving the spotted owl (March 23, 1989) halted 139 timber sales (Seattle Audubon Society et al. v. Robertson (No. c89-160WD)). Ninth Circuit Court Judge William Dwyer stayed the sales in question until he could consider the suit before him. It was based on one NFMA violation–the Forest Service failed to maintain a viable population of owls, and on two NEPA violations–no worst case scenario was considered, and the Forest Service did not respond to credible and contrary criticism of the plan.

Dwyer's Permanent Injunction came on July 2, 1992 (Seattle Audubon v. Moseley (No. c92-479)). This was decided on summary judgment in part because the Forest Service gave no explanation or justification for having chosen an alternative in the Regional Guide which had a "low to medium probability of providing for viable populations of late-successional forest associated wildlife." The Forest Service responded by saying they only needed to provide for the owl. Dwyer subsequently ruled on why NFMA requires "planning for the entire biological community—not for one species alone." Subsequently, President Clinton commissioned FEMAT, the pinnacle ad hoc scientific team, to

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resolve the west side old-growth debate once and for all. FEMAT, which attempted to minimize economic impact, recommended a timber harvest 75% to 85% lower than the Forest Service's published Forest Plans. Under the viability clause, Judge Dwyer deemed it legal.

East of the Cascades in the Columbia Basin, the subsequent fear of an injunction led to an ad hoc scientific assessment for that region beginning in 1993. Maximum diameter limits on timber harvests and increased protection on riparian habitat were put in place as an interim measure to ward off litigation until a comprehensive plan could be developed. However, much of the early work based on preliminary acceptance and use of science-based assessment and monitoring was trumped once National Oceanic and Atmospheric Administration (NOAA) listed upper Columbia River salmon under the ESA in 1997. The focus moved from science-based planning to consultation with regulatory agencies. The outlook changed from adaptive restoration to non-prioritized, ultra-conservative species protection (Sedell, personal communication). ICBEMP worked for over nine years trying to address NFMA's viability standard in addition to the ESA requirements before it was shelved by the Bush administration in February of 2003. The interim guidelines remain in place.

4. Discussion and conclusions

The National Forest Management Act was born out of a need for an honest appraisal of the long-term effects of management actions on the National Forests. By developing and collaborating on Forest Plans that articulate the long-term vision for any forest, it was assumed that the agency could avoid short-sighted decisions. Subsequently, ad hoc science teams reviewed the plans produced in the 1980s and rated them as inadequate to ensure viable populations of fish and wildlife. Instead, they recommended substantial decreases in timber harvest accompanied by extensive restoration and conservation strategies as the only way to meet the requirements of NFMA. Although in none of the instances described did the scientists who were tasked with science assessments actually write or decide on the specific management strategy that was proposed or implemented, nor make the call as to whether a given species would be viable, there had nonetheless been an unmistakable shift in management emphasis.

How could two such divergent outcomes result from the same legal mandate? Our four hypotheses attempt to answer this question.

The first two propositions (characterizations of risk, and raising the viability bar) are closely linked, and tied inextricably to the circumstances of the time. In other words, given the viability language of the 1982 regulations and the state of the science, there was ample room for different characterizations of risk. Viability analysis was a new science with little agreement about its application in management. Planners and interdisciplinary team members working on Forest Plans approached planning from a perspective that differed substantially from that of the scientists in ad hoc groups. The members of the ad hoc teams had access to the latest data, and had more experience with this type of analysis. They could act independently of agency expectations. Together with the expanding scope of their assessments, these factors contributed to their different characterization of risks to viability protection.

Our third hypothesis is based in institutional theory. Many scholars would argue that no large bureaucracy is capable, ever, of introducing change to the status quo (e.g. Bella, 2001; Hirt, 1999). Federal forests in the Pacific Northwest had a long tradition of timber production, and the change required to meet the viability language in the 1982 planning regulations ran into insurmountable resistance within the agency. But although the recommendations of the external ad hoc assessments were only partially implemented, they did disrupt the institutional momentum enough to allow room for broad-scale changes.

The fourth hypothesis, like the first two, is tied to the circumstances of the times. The groundswell of environmental awareness born in the 1960s had not abated in any sense, and now the laws were in place to back it up. In addition, the 1980s and early 1990s in the Pacific Northwest constituted an economic transition period. Job cuts had already affected resource-dependent rural communities. The high-tech boom had sent more people to the cities, and generated new funds that would help support the burgeoning environmental movement; urban dwellers

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tend to view the forests as play areas rather than economic opportunities. Membership in environmental groups soared and people were willing to go to court to defend their points of view. These factors created a social atmosphere conducive to a major shift in forest policy on public lands. The problem, captured in our third hypothesis, was that the Forest Service was not able to adjust to the shift as rapidly as the society in which it operates.

The feeling, expressed universally by our interviewees, that we will not repeat the conflicts associated with the Forest Plans of the 1980s, is shaped in part by the decreased emphasis on timber production within the Forest Service. Several interviewees believe that new viability protection standards have been clarified through the wrangling of the early 1990s (Quigley, Phillips, Gunderson, personal communication). The conflict of the past, they believe, will add depth to future planning processes. There is now a broad body of case law which has set a precedent, giving a better idea of the appropriate level of protection (Sedell, Gunderson, personal communication). There is a higher level of oversight in place to avoid surprises (Phillips, personal communication). And it is conceivable that the Forest Service will in the future avoid the kind of legal missteps–specifically, failure to comply with its own procedures–that environmentalists could so easily exploit in the courts.

There was universal acknowledgement among interviewees that the viability protection bar has been raised, and while the 1982 regulations remain the law, there is no incentive to lower it again. It is interesting to note how many players in the events of the late 1980s and through the 1990s could name–definitively, they all thought–the specific turning point, after which they believed there was no turning back. The agency has accumulated more data and has greatly advanced its analytical capabilities. This has improved our understanding of species conservation, reducing the potential for repeating such a conflict (Quigley, Kerrick, personal communication). To avoid future technical inconsistencies, it was suggested that in the future ad hoc scientific assessments should set the sideboards of all future plans; the range of acceptable actions would then be available to planners a priori.

Our study outlines a somewhat pessimistic view of the efficacy of forest planning regulations. Two quite dissimilar outcomes from a single set of regulations *both* failed to gain full acceptance. Our data suggest that while one may have been the last gasp of a dying regime, and the other too radical to be accepted immediately, the fact is, each was crippled by the incremental nature of scientific understanding, institutional problems, and larger social dynamics.

Thus the status of current federal forest management in the Pacific Northwest is a hybrid of divergent planning efforts, a series of court decisions, and an array of temporary fixes. Crisis management and angry voices have become the questionable norm. Against this background, there remains one crucial question for any set of regulations: do they allow for a fair-minded evaluation of our choices among management activities?

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Acknowledgements

The idea for this paper came originally from K. Norman Johnson. Norm was a key actor in the development of Forest Plans and in all the ad hoc groups we cited, and has been pondering the issues raised in this study for more than a decade. We thank him for the opportunity to work closely with him and explore his insights. We also thank our 10 interviewees (see Table 1) for their time and thoughtful comments. We could not have made sense of the paper trail without their input. And we thank Fred Swanson, Amanda Robillard, Norm Johnson, John Bliss, and Hal Salwasser for the helpful and insightful comments on the manuscript. A coin toss determined the authorship of this manuscript.

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